AMERICAN MACHINIST

NOVEMBER 26, 1942

ARMAMENT SECTION: Welding A.A. Gun Recoils—Page 1371

THERE'S A REASON!

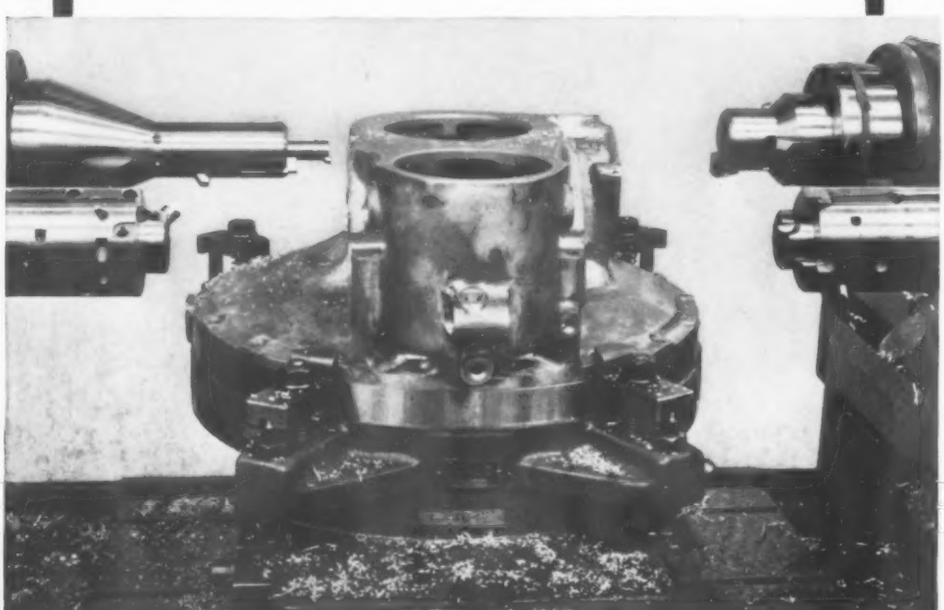
MORE THAN 100 AIRCRAFT PARTS ARE PRECISION FINISHED ON HEALD BORE-MATICS AND GRINDING MACHINES

- Cylinders
- Cylinder Muffs
- Cylinder Heads
- Crankcases
- Lower Half Crankcases
- Crankcase Sections
- Crankcase Center Sections
- Crankcase Front Sections
- Rear Crankcase
- Crankcase Covers
- Intermediate Crankcase
- Wheelcases
- Volute Casings
- Gear Cases
- Reduction Gear Cases
- Reduction Drive Supports
- Front Covers
- Oil Pumps
- Bearing Supports
- Rear Cam Supports
- Master Rods
- Articulating Rods
- Pistons
- Piston Pins
- Crankshafts
- Crankshaft Rear Sections
- Crankshaft Center Assemblies
- Crankshaft Dynamic Balancer Weights
- Gears
- Impeller Shaft Gears
- Oil Pump Bodies
- Oil Pump Covers
- Fuel Pump Bodies
- Oil Pump Scavenger Casings
- Water Pump Casings
- Master Rod Bearings
- Crankshaft Bearings
- Bushings
- Master Rod Spacer Bearings
- Valve Inserts
- Valve Tappets
- Valve Tappet Guides

There's a good reason, too, why leading aircraft manufacturers use Heald Bore-Matics and Heald Internal and Surface Grinding Machines for finishing the more than 100 aircraft parts listed here — that reason, in one word, is *precision*.

Every one of these 100 parts is a highly important aircraft component, every one represents a costly investment in vital craftsmanship and valuable materials, but all of them could be quickly reduced to mere scrap if improper finishing methods were employed. That's why finishing methods and equipment are so important in aircraft production.

The fact that the aircraft industry has chosen Heald Bore-Matics and Grinding Machines for precision finishing such a wide variety of aircraft components speaks for itself. And it's a mighty good reason that you, too, when you specify precision, specify HEALD.



ABOVE — Here a Heald No. 49 Double End Bore-Matic bores, faces and chamfers 21 surfaces in crank case rear covers made of magnesium alloy, all in one work setting.

- Valve Spring Lock Washers
- Valve Spring Washers
- Carburetor Bodies
- Spark Plug Parts
- Magneto Housings
- Magneto Breaker Adapters
- Magneto Plate
- Magneto Gear Housing
- Distributor Gears
- Distributor Blocks
- Generator Frames
- Generator End Shields
- Boost Control Housings
- Camshaft Brackets
- Clutch Selector Housings
- Crank Pin Oil Plug
- Crankshaft Oil Plug
- Fuel Pump Drive Shaft
- Fuel Pump Drive Shaft Support
- Gear Housings
- Knuckle Pin Locking Plate
- Push Rod Ball Ends
- Regulator Housings
- Roller Cams
- Valve Housings
- Valve Brackets
- Valve Bushings
- Control Motor End Shields
- Selsyn Motor Stators
- Hydraulic Operating Cylinders
- Gun Synchronizer Bearing Liners
- Tail Gear Treadle Assemblies
- Propeller Blades
- Propeller Blade Bushings
- Propeller Shafts
- Propeller Hubs
- Propeller Shaft Bearings
- Propeller Spiders
- Propeller Cams
- Propeller Hub Cones

★ ★ ★ ★ ★ ★ ★

THE HEALD MACHINE CO. WORCESTER, MASS., U. S. A.

MANUFACTURERS OF PRECISION BORING AND PRECISION GRINDING MACHINES

AMERICAN MACHINIST

November 26, 1942

War Cradles—The final set-ups on recoil mechanism cradles use operators that have specialized in certain welds

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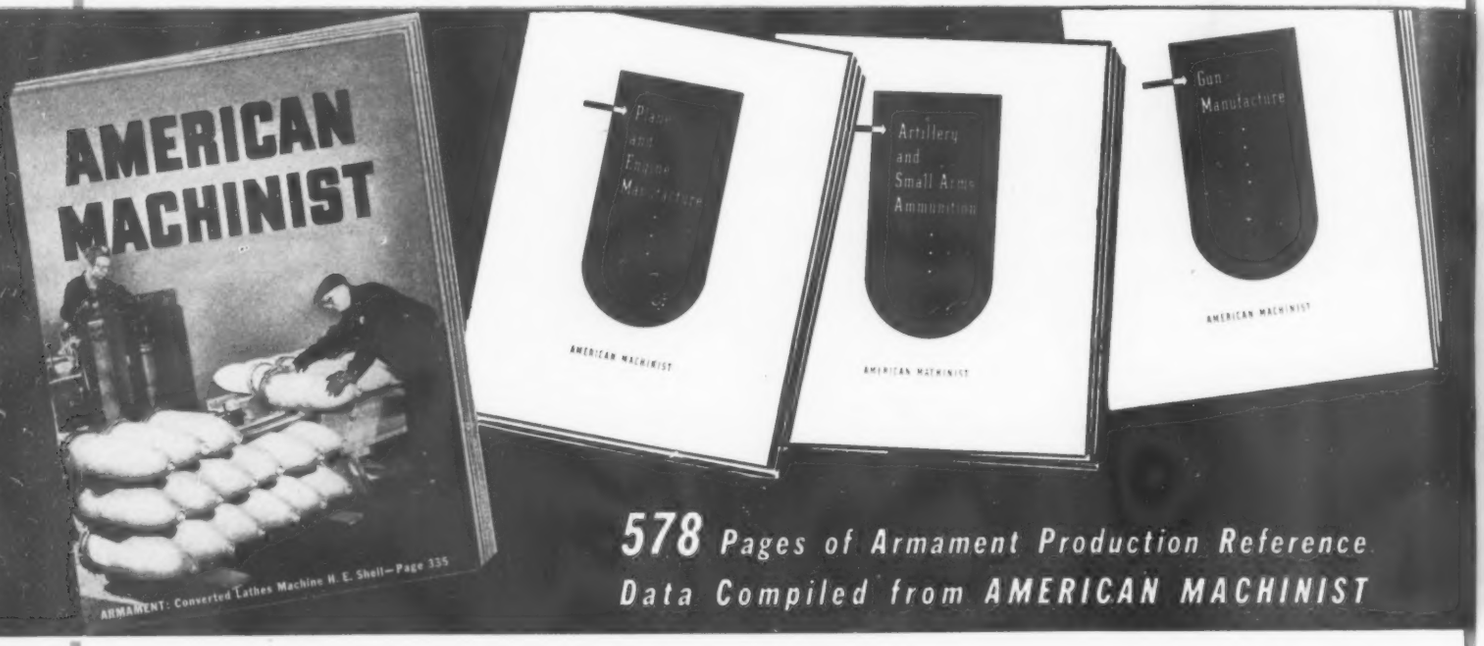
Now

6,000 STRONG

in the service of war production



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★ Thousands of man-hours are being saved in plants all over the country by these textbook compilations of articles and Armament Sections appearing originally in *American Machinist* during the past two years.

They contain practical how-to-do-it munitions production data written by and for practical men. Data available *nowhere else.*

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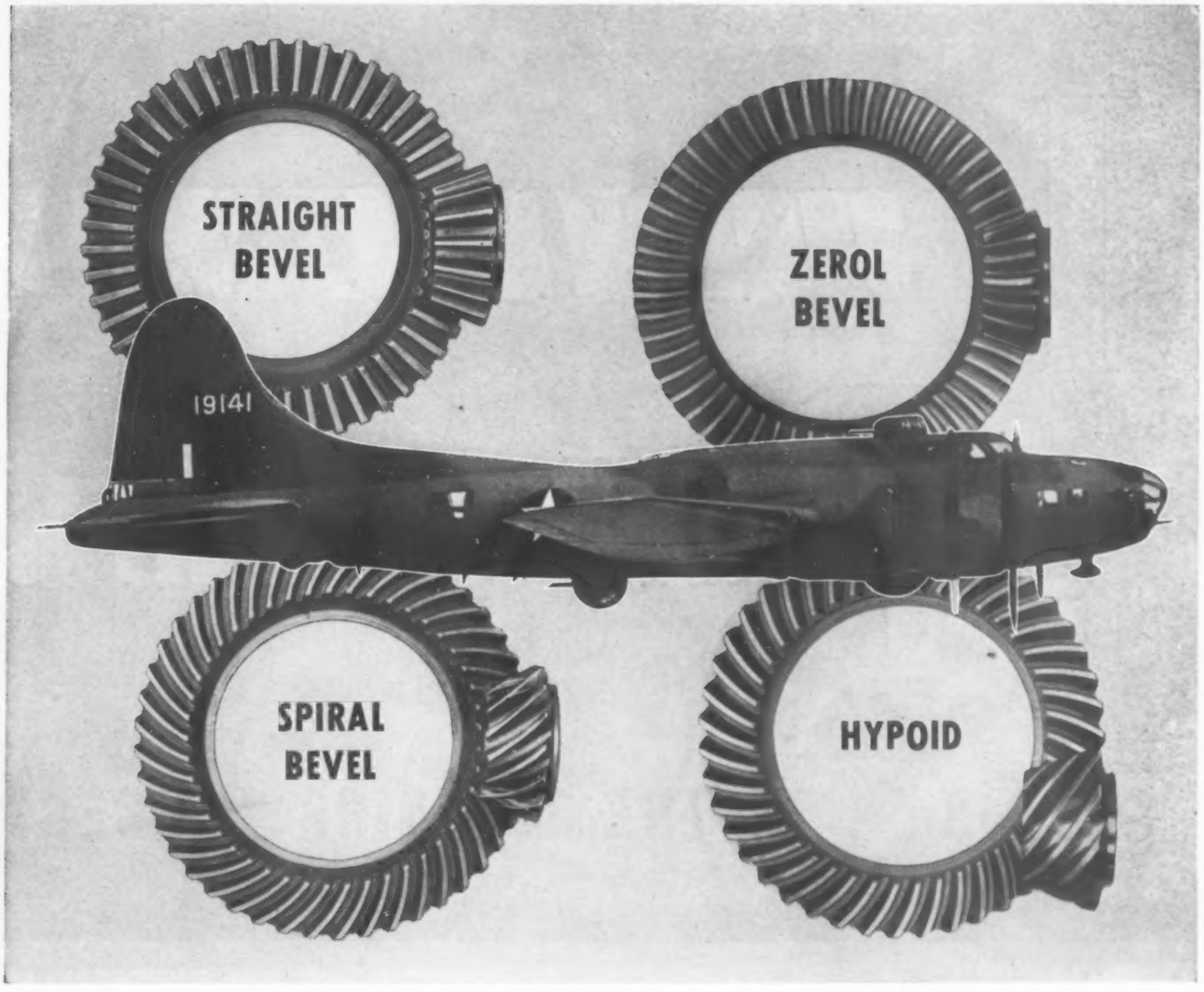


BOMBERS WITH *TEETH!*

In more than one sense of the word do the mighty bombers of the U. S. Air Force have "teeth." Swift, powerful, and deadly, they are a main source of striking power against the Axis.

—But to the Gleason Works the word "teeth" suggests another thought—of the countless bevel gears that make possible this huge striking arm. —From the bombardier's cockpit to the "stinger" turret at the tail, hundreds of bevel gears cut on Gleasons provide reliable, accurate power transmission for essential mechanisms.

Motor gears, automatic propellers, reduction units, landing gear, aileron and rudder controls, instruments—these are but a few of the places where bevel gears are found in today's bombers.

In war plants throughout the country Gleason machines are turning out these gears in ever-increasing quantities. Operating at the highest known standards of accuracy, producing more and finer bevel gears, *Gleasons are literally putting the TEETH in our air forces.*

GLEASON

GLEASON WORKS

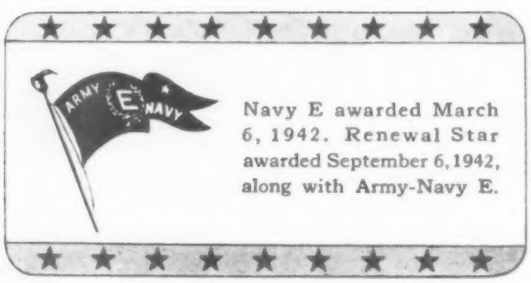
Builders of Bevel Gear Machinery for Over Seventy-five Years

1000 UNIVERSITY AVENUE, ROCHESTER, N. Y., U. S. A.

FUNCTIONAL DIAGRAMS

STEP No. 1 IN THE TRAINING PROCESS

Hundreds of concerns are finding these functional diagrams useful for training men and women to become proficient milling machine operators. The diagrams point out the operating controls and construction details, and are extremely helpful for instruction purposes. They are lithographed on durable stock, 22 x 34 inches in size, and are available for many CINCINNATI Milling Machines. Complete list of diagrams is shown on the opposite page.

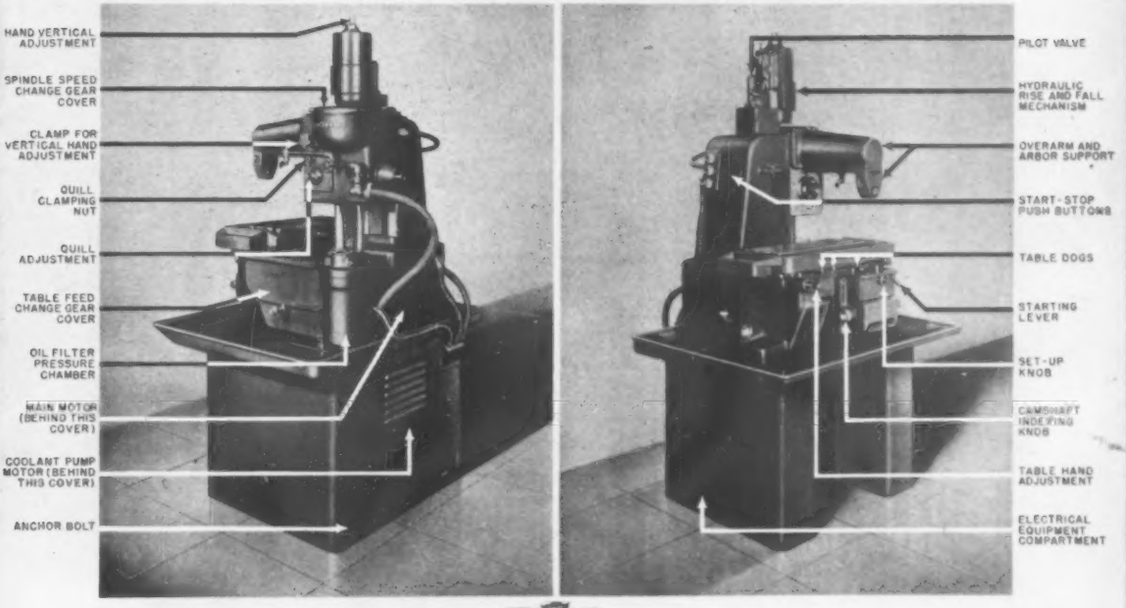


Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

THE CINCINNATI

TOOL ROOM AND MANUFACTURING

Cincinnati NO. 0-8 PLAIN AUTOMATIC
MILLING MACHINE



CINCINNATI

THE CINCINNATI MILLING MACHINE CO. CINCINNATI, OHIO, U.S.A.

Functional diagrams are official communiques from Milling Headquarters. They are available for the following CINCINNATI Milling Machines:

- No. 2 L-Type and MH Milling Machines
- No. 2 Cutter and Tool Grinder
- Dial Type Milling Machine
- 1-12 and 1-18 Plain Automatic Milling Machines
- 2-18 and 2-24 Plain Automatic Milling Machines
- 0-8 Plain Automatic Milling Machines
- 0-8 Vertical Milling Machines

Please ask for only those diagrams in which you are especially interested.

Specification catalogs fully explaining features and benefits of all CINCINNATI Milling Machines are also available. When writing for catalogs please mention type of milling machine in which you are primarily interested.

CINCINNATI

MILLING MACHINE CO. CINCINNATI, OHIO, U. S. A.

MILLING MACHINES • SURFACE BROACHING MACHINES • CUTTER SHARPENING MACHINES

One of t

This is not a pleasant story. We are about to name the murderer in a case that has long been listed as suicide . . . and that murderer is still alive, known to many who read this story.

It happened many years ago. A man named John Fitch was supposed to have taken his own life. The truth is, he was killed — in one of the most reasonless, strange and brutal of all crimes.

He was a shabby man, who tramped through life with the frenzy of a fanatic, clutching a vision under his arm — the plans, designs and models of an invention that would revolutionize this world and bring a new era of wealth and progress to the people of his country . . . They told him that it couldn't be done.

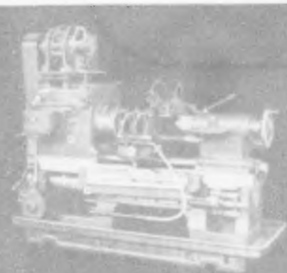
For 15 years he shouted in a wilderness of deaf indifference, hammered at the closed doors of political thought, was branded as crazy, humiliated in public, bereft of funds, and finally killed. They say that he took an overdose of narcotic pills, but the fact is John Fitch was murdered.

He was murdered by indifference! Ignorance, stupidity and political blindness killed John Fitch — but not the vision he had offered to the world. It was the plans of a steamboat, designed, built and successfully operated 20 years before the world ever heard of Robert Fulton.

We have a purpose in telling this story. It's simply this: Men are still murdered by indifference. Vision is still rewarded with "It can't be done," *perhaps now more than ever before!* Because this is true, we believe that a single fact about Jones & Lamson may be important to you.

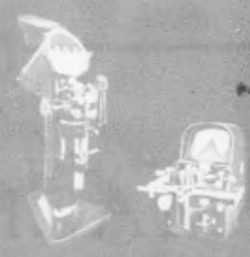
Today, the foremost engineers and designers in America are entrusting their plans and problems to Jones & Lamson for counsel, service and technical assistance in the use of precision machine tools.

If it CAN be done . . . and if tools are needed to do it . . . Jones & Lamson engineers and service men are considered among the best qualified in America to help you.



FAY AUTOMATIC LATHES

AUTOMATIC THREAD GRINDERS



OPTICAL COMPARATORS

AUTOMATIC OPENING DIE HEADS

of the strangest

Murders of all time

DURING the past 12 months of war, American manufacturers — from the largest to the smallest — have called upon Jones & Lamson literally thousands of times for counsel, service or precision machine tools.

If your business is manufacturing with metal . . . if you have problems today . . . and if you are planning ahead for the post-war world of new products, markets and methods of manufacture, Jones & Lamson engineers and service men can help you. They are at your call!

JONES & LAMSON
MACHINE COMPANY

Manufacturers of . . . Universal Turret Lathes . . . Fay Automatic Lathes Automatic Thread Grinders . . . Optical Comparators . . . Automatic Opening Die Heads

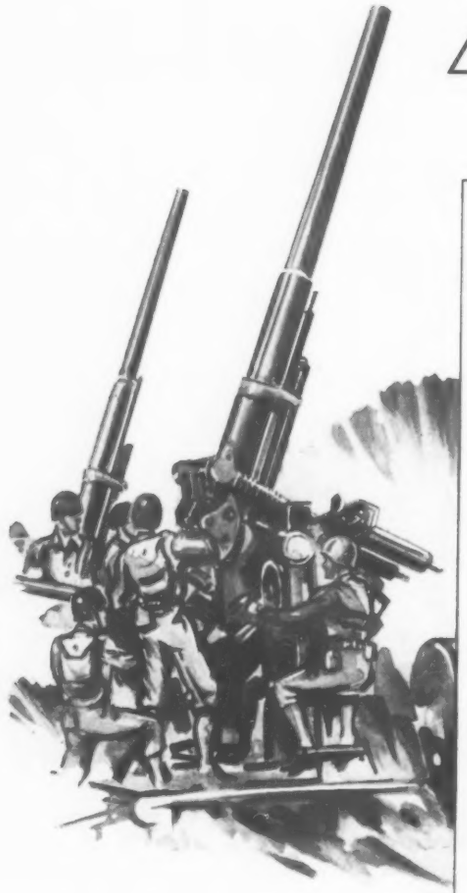
Springfield, **Vermont, U. S. A.**

SADDLE TYPE
UNIVERSAL TURRET LATHES

PROFIT-PRODUCING
MACHINE TOOLS

RAM TYPE
UNIVERSAL TURRET LATHES

Zero **BACKLASH**



WAR PRODUCTION BULLETIN

Fine-pitch Gears, Pinions, and Rack-teeth cut to Zero Backlash Specifications... on

CENSORED

are Typical Fellows Jobs.

FELLOWS

MACHINES AND TOOLS FOR GEAR PRODUCTION

PRECISION

...VIA 3 STANDARD FELLOWS GEAR PRODUCTION MACHINES

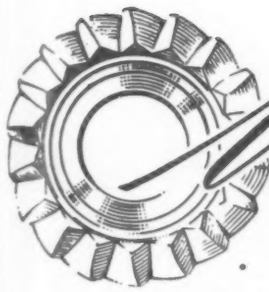
1. **Gears are 32, 48 and 64 pitch involute teeth which are cut on the Fellows Straight-Line Gear Generator.**
2. **A superfine finish and exceptional concentricity obtained via the No. 4 Fellows Enveloping Gear Generator.**
3. **Burnishing on the No. 4 FELLOWS Gear Burnishing Machine.**

▲

With this series of machines, cutters and tools, which comprise "The Fellows Method," the necessary precision is obtained. It was natural, that a job of Zero backlash specifications should gravitate to Fellows equipment.

It is apt, however, to record the additional fact that precision, via Fellows Methods, can be combined with overall economy. Fellows engineers are prepared to discuss with you ways and means of low-cost, high-precision gear manufacture, for 175-pitch pinions or gears up to 120 inches diameter.

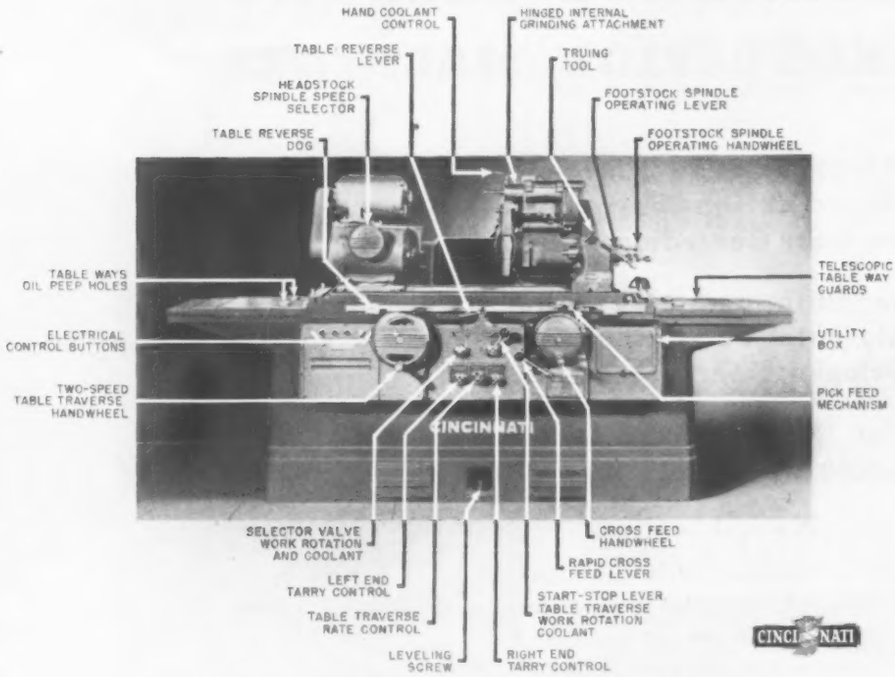
For catalog or special information write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Chicago, or 640 West Town Office Bldg., Detroit.



Method

. . . . FROM BLANK TO FINISHED GEAR

Cincinnati 12" HYDRAULIC UNIVERSAL GRINDER



CINCINNATI GRINDERS INCORPORATED, CINCINNATI, OHIO, U.S.A.

CINCINNATI Hydraulic Universal Grinding Machines are available in 12", 14", 16" and 18" swings; between center distances up to 72". Specification Catalogs G-486 and G-474 give complete details on all features and their benefits.

CINCINNATI

ARMY E NAVY

Navy E awarded March 6, 1942. Renewal Star awarded September 6, 1942, along with Army-Navy E.

CINCINNATI

CENTER TYPE GRINDING MACHINES

way

TO GET ACQUAINTED

The quickest and easiest way for new employees to become thoroughly acquainted with CINCINNATI Grinding Machines is through the use of illustrated, functional diagrams which indicate the location of features and controls and explain their function.

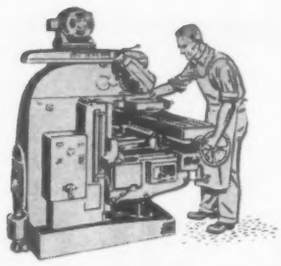
These diagrams are official communiques from Grinding Headquarters. They are available for CINCINNATI 12″ Hydraulic Universal Grinding Machines; 6″ and 10″ Saddle-Type Hydraulic Grinding Machines and No. 2 Centerless Grinding Machines. Copies of any or all will be sent free to those interested in training men and women for machine shop work. They are 22 x 34 inches, lithographed on durable stock and may be used as wall charts.

Exclusive features of the 12″ CINCINNATI Hydraulic Universal illustrated below and on the opposite page include: Filmatic Grinding Wheel Spindle Bearings • Hinged Type Internal Grinding Attachment driven by Independent Motor • Infinitely Variable Work Speeds • Accuracy of Table Reversal Within .004″ • Dog-Controlled Table Reciprocation from 3/32″ to Full Table Stroke • Independent Right- and Left-Hand Tarry Adjustments • Two-Speed Hand Cross Traverse • Tableways that are Protected by Telescopic Guards.

GRINDERS INCORPORATED

CINCINNATI, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES



OPERATORS ALWAYS HAVE

"Control of the Situation"

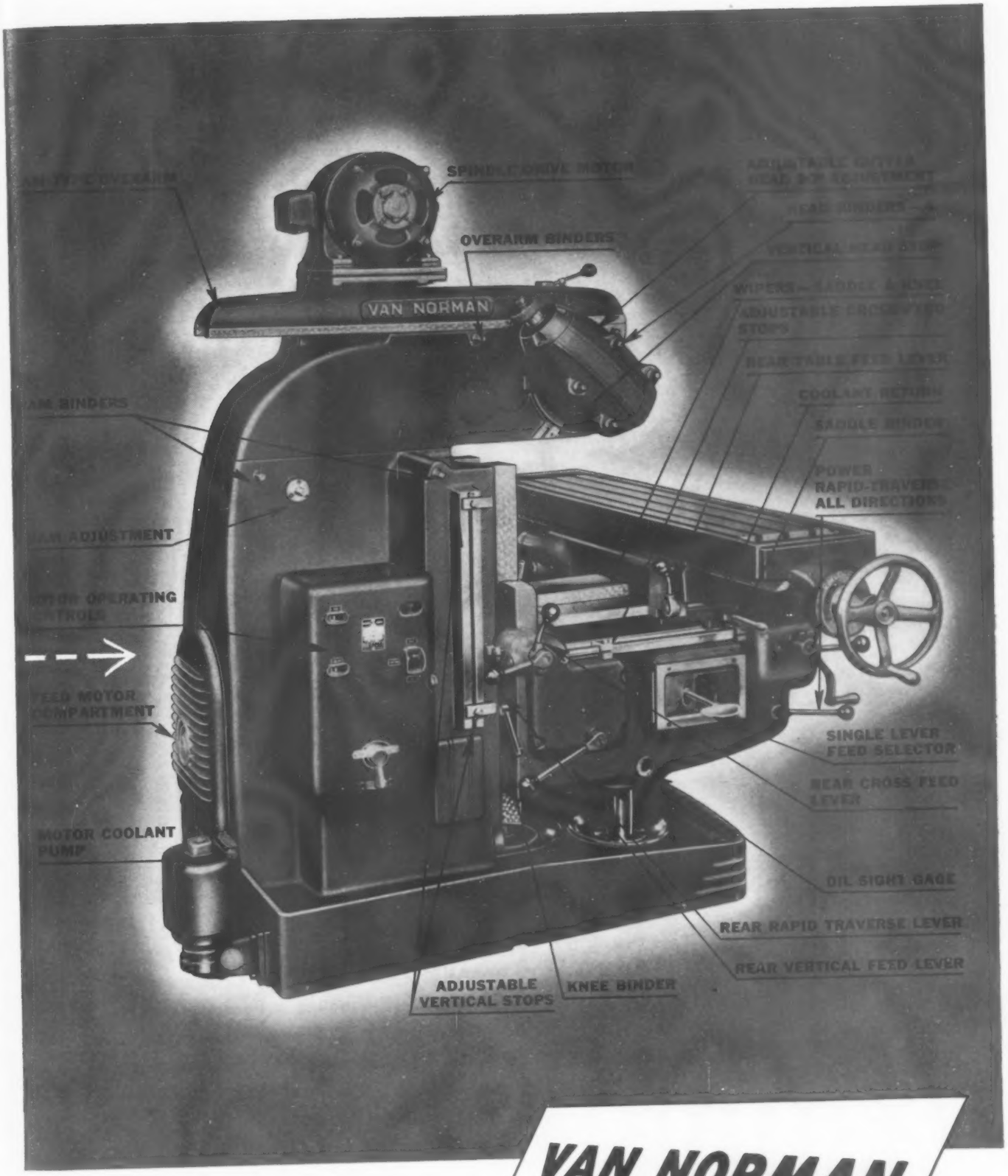
...ON VAN NORMAN RAM-TYPE MILLERS

All controls and adjustments are right at hand . . . quick and easy to use . . . on Van Norman Ram-Type Millers. So operators can turn out better work and more of it, in less time. Operators also find their work lightened and speeded up by front-and-rear controls of power feeds and 6-way rapid traverse . . . single-lever selectors of feeds and speeds . . . and large, glare-proofed dials that are easy to read.

Many jobs can be carried to completion . . . through successive vertical, angular and horizontal cuts on the same machine . . . simply by resetting the cutterhead, instead of taking the time (and the risk of errors) otherwise required to reset the work. In fact, every feature of Van Norman Ram-Type Millers is designed to combine highest accuracy with greatest ease of operation, on toolroom and production jobs.

SPECIFICATIONS:
No. 26 RAM-TYPE MILLER:
Table: 50" x 12"
Range: 28" longitudinal, 12" cross, 18" vertical
18 Speeds: 30 to 1500 rpm
18 Feeds: 3/16" to 32"

VAN NORMAN MACHINE TOOL CO., SPRINGFIELD,



MASSACHUSETTS

VAN NORMAN
Milling Machines

LANDIS
MACHINE COMPANY
WAYNESBORO, PA., U.S.A.

LANDMACO Threading Equipment is capable of handling your most exacting threads on a high production basis and your commercial threads on a super production basis. In war plants throughout the nation, LANDMACO is daily setting performance records for extreme accuracy and greater production. If you have a Threading problem in your plant our engineers are ready to help you solve it.

Write for Bulletin H-75

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

"Photo By U. S. Army Signal Corps"→

LANDIS Hardened and Ground Die Heads possess many superior and exclusive features. All parts are hardened to insure maximum wearing qualities and are precision ground to guarantee accuracy.

The few operating parts of LANDIS Die Heads and their precise assembly make it possible to produce threads within extremely close tolerances on a high production basis.

Write for Bulletin F-80-3

LANDIS
MACHINE COMPANY
WAYNESBORO, PA., U.S.A.

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS

The AMERICAN PACEMAKER...

... offers 27 spindle speeds with only 2 control levers

Control convenience and easy operation are two of the many outstanding features offered in "AMERICAN" Pacemaker Lathes.

Any one of 27 spindle speeds is available through only 2 conveniently placed direct reading levers *without having to refer to index plates or having to remember lever positions.*

Operators are highly enthusiastic in their praise of this new "AMERICAN" speed control. They like it because their work is easier; they are able to produce more work with this simplified control. Pay roll dollars buy more production because of this modern "AMERICAN" development.

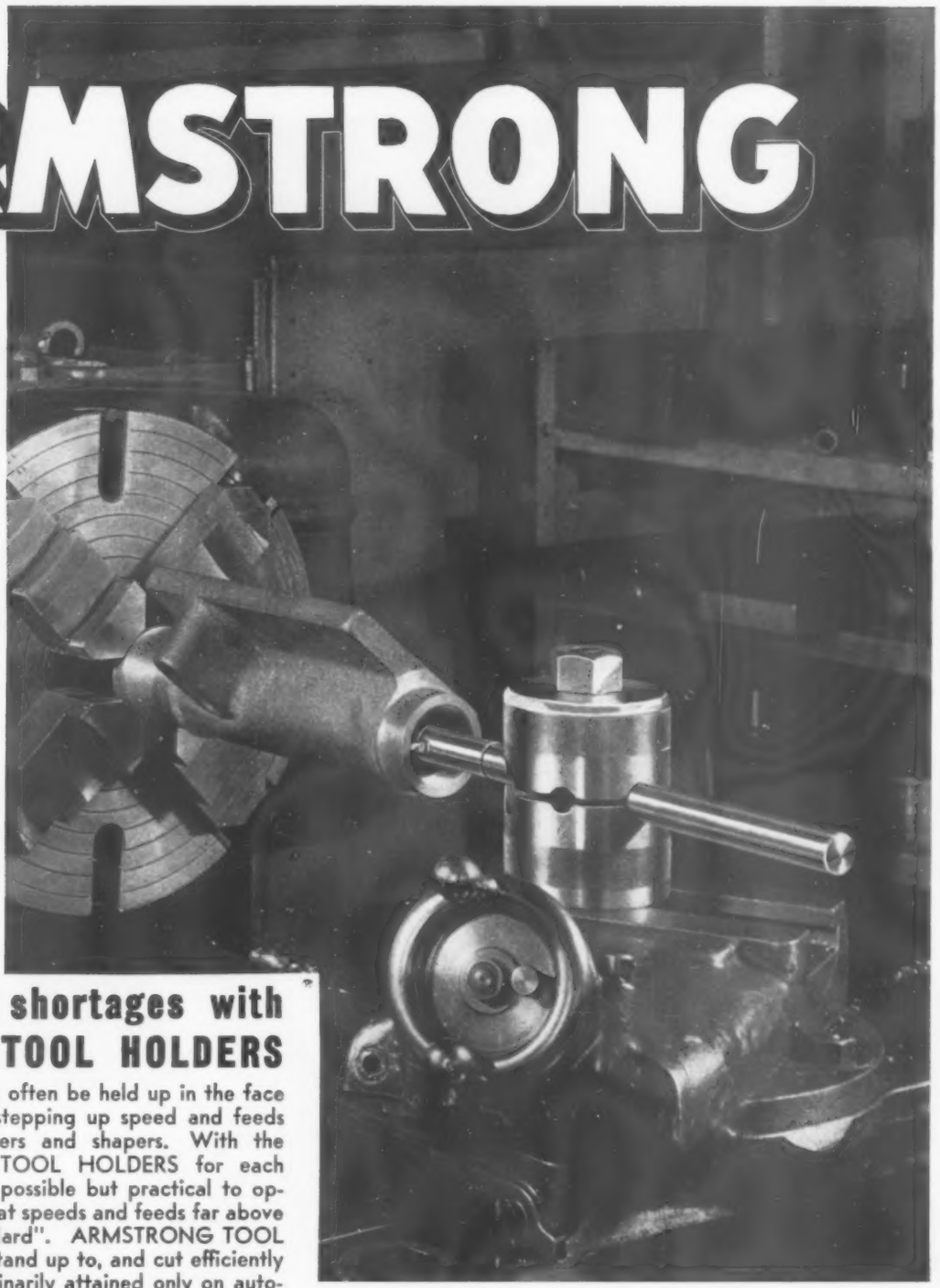
This feature and others equally valuable are fully described in the "AMERICAN" Pacemaker Bulletin No. 15. Send for your copy today.

The AMERICAN TOOL WORKS CO.

Cincinnati, Ohio, U.S.A.

LATHES • RADIALS
SHAPERS

ARMSTRONG



Make up for shortages with ARMSTRONG TOOL HOLDERS

Production schedules can often be held up in the face of a labor shortage by stepping up speed and feeds on lathes, planers, slotters and shapers. With the correct ARMSTRONG TOOL HOLDERS for each operation, it is not only possible but practical to operate these machine tool at speeds and feeds far above those accepted as "standard". ARMSTRONG TOOL HOLDERS will not only stand up to, and cut efficiently and safely at speeds ordinarily attained only on automatic production tools. If hampered by a shortage of labor or machine tools, your first logical move is to step-up all operations employing ARMSTRONG TOOL HOLDERS.

Equal to the shortage of men and machine tools is the shortage of high-speed-steel. Here again the use of more ARMSTRONG TOOL HOLDERS is logical because ARMSTRONG TOOL HOLDERS save: 90% high speed steel—make each ounce of high speed steel do the work of 10 ounces in forged tools.

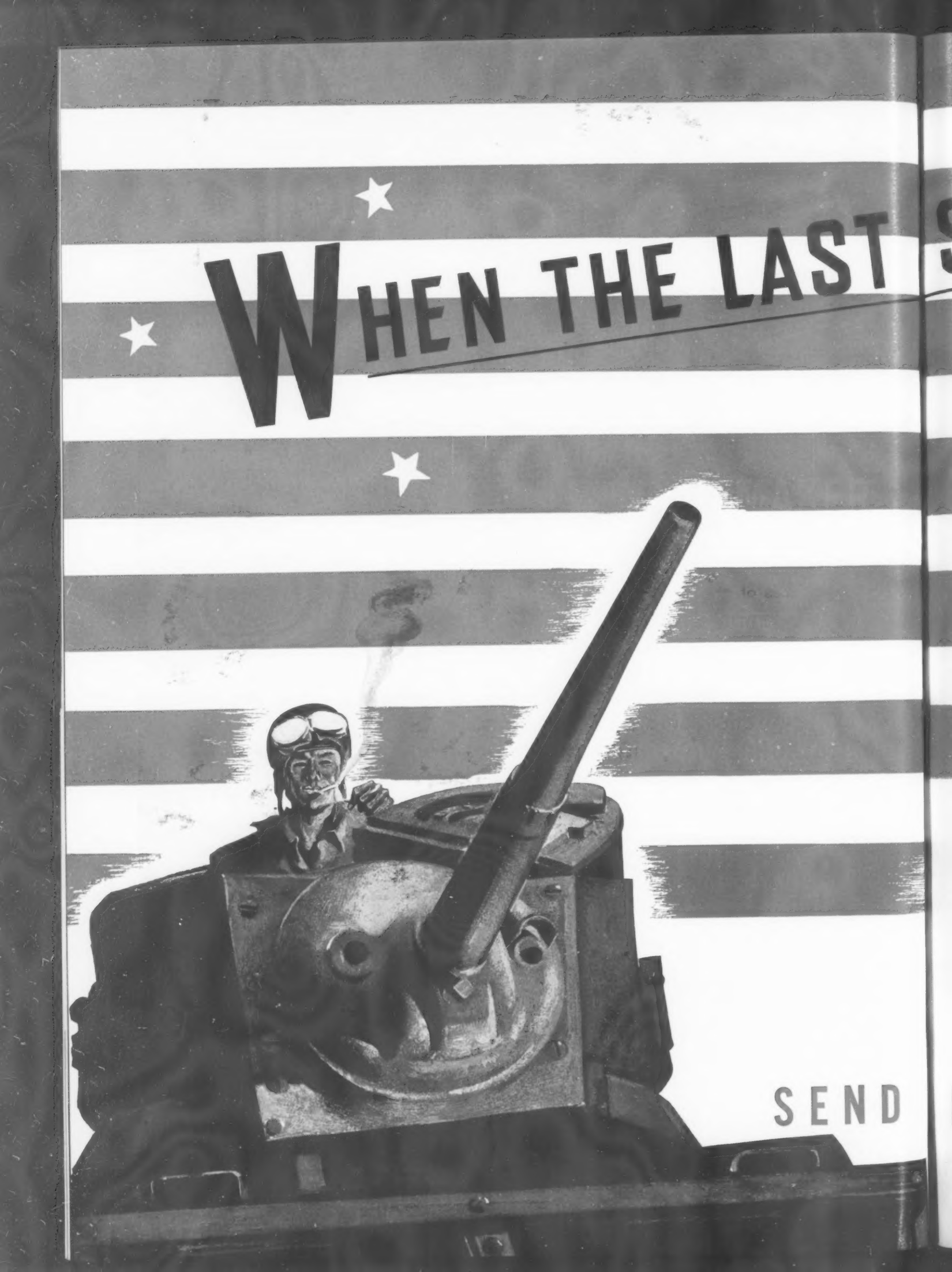
Write for Catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. FRANCISCO AVE. CHICAGO, U. S. A.

Eastern Warehouse & Sales:
199 Lafayette St., New York

Buy ARMSTRONG TOOLS from your Supply House

ARMSTRONG TOOL HOLDERS Are Used in Over 96% of the Machine Shops and Tool Rooms


WHEN THE LAST
SEND

SHOT IS FIRED...

WHEN the smoke of destruction has cleared, and America returns to peace, what of victory will be ours? What will be left?

Here is one thing: A greater production plant than men ever dreamed possible, and the war-learned efficiency to handle that plant under the most drastic circumstances of change-over and production.

Here is another: New techniques, new skills, new and better and cheaper materials, and more abundant sources of supply than ever before, with a new price structure based upon *full* production by small plants as well as large.

And here is another thing that will be left, when this war is finally over: One of the greatest consumer markets this country has ever seen, with billions in savings from war bonds and restricted buying, needing millions of automobiles, appliances, homes, and the countless new products that will appear.

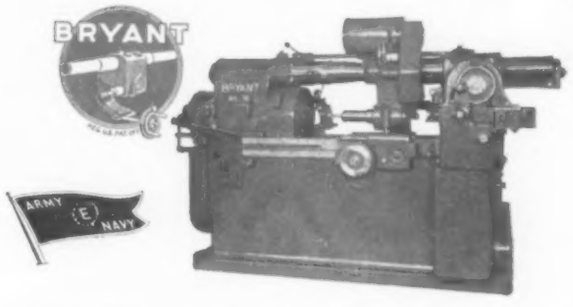
For the last gun to be fired in this war will be the starting gun of the greatest era of peacetime advancement this world has ever known.

If you are to share in the future of the new world, after this war is over — if you are to successfully compete for the new peacetime markets of America — the time to start production planning is *now* . . . and in this we can help you:

Write to Bryant! Send us your internal grinding problems, and take advantage of the work that our engineers can do *now* to convert your plant and its tools to the profitable job that lies ahead!

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U.S.A.



FOR THE MAN FROM BRYANT

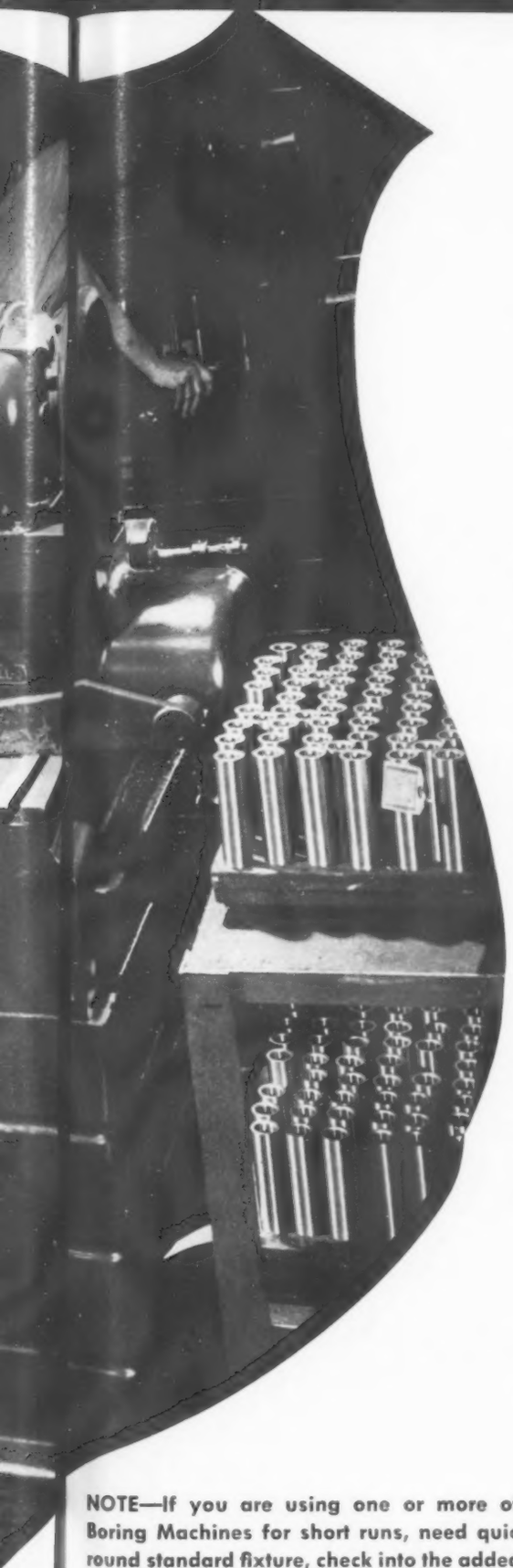
"It's an

EX-CELL-O

. . . PRECISION WORK IS A 'CINCH' ON THIS MACHINE!"

Over each of the four plants of Ex-Cell-O in Detroit fly three flags . . . the Stars and Stripes, as always, the Army-Navy "E" pennant, and the *first* U. S. Treasury "Bull's-Eye" War Bond flag.

Precision THREAD GRINDING, BORING AND LA
POWER UNITS • GRINDING SPINDLES • BROACHES •
INGS • DIESEL FUEL INJECTION EQUIPMENT R.



YES, all EX-CELL-O machine tools do *precision* work . . . they are purposely designed and built that way. As a matter of fact, it's now common practice throughout the metal-working field to use EX-CELL-O as another word for *precision*. Take the machine tool illustrated here. It's one of nine standard styles of EX-CELL-O *precision* boring machines, thousands of which are doing 24-hour duty in practically every type of American war industry. They are performing a wide variety of machining operations—boring, turning, facing, grooving, chamfering—where tolerances are extremely close and the highest production is essential. Their flexibility in use, their compact construction, their smooth and easily-controlled operation, their great strength and extreme rigidity . . . all these standard features make every EX-CELL-O *Precision* Boring Machine a favorite with both operators and owners under today's strenuous production pace.

EX-CELL-O CORPORATION · DETROIT

To get best use of your Ex-Cell-O precision boring equipment, you should have the Ex-Cell-O Instruction Book. If you do not have it, write for free copy. State style of Ex-Cell-O machine you are using.

NOTE—If you are using one or more of your Ex-Cell-O Precision Boring Machines for short runs, need quick change-overs, or an all-round standard fixture, check into the added flexibility and time-saving advantages that an Ex-Cell-O Universal Fixture will give you. Work, fixtures and tools can be quickly, easily and rigidly mounted in any desired position on the vertical slide of this fixture and the slide may be set at any desired angle for boring, turning, or facing.

AND LAPPING MACHINES • TOOL GRINDERS • HYDRAULIC
CHES • CONTINENTAL CUTTING TOOLS • DRILL JIG BUSH-
NT R. R. PINS AND BUSHINGS • PRECISION PARTS

XLO
EX-CELL-O *means* PRECISION

FRIDAY

motor failure

MONDAY

WAR PRODUCTION AS USUAL

125 HP FOUNDRY MOTOR FAILED FRIDAY, 4 AM. EMERGENCY CALL TO NEAREST WESTINGHOUSE MANUFACTURING & REPAIR PLANT STARTED WORK IMMEDIATELY. NEW COILS FORMED, INSULATED, TREATED, STATOR STRIPPED, REWOUND, DIPPED, BAKED, TESTED. DELIVERED MONDAY, 2 PM, TO WAR PLANT. BAD NEWS FOR AMERICA'S ENEMIES.

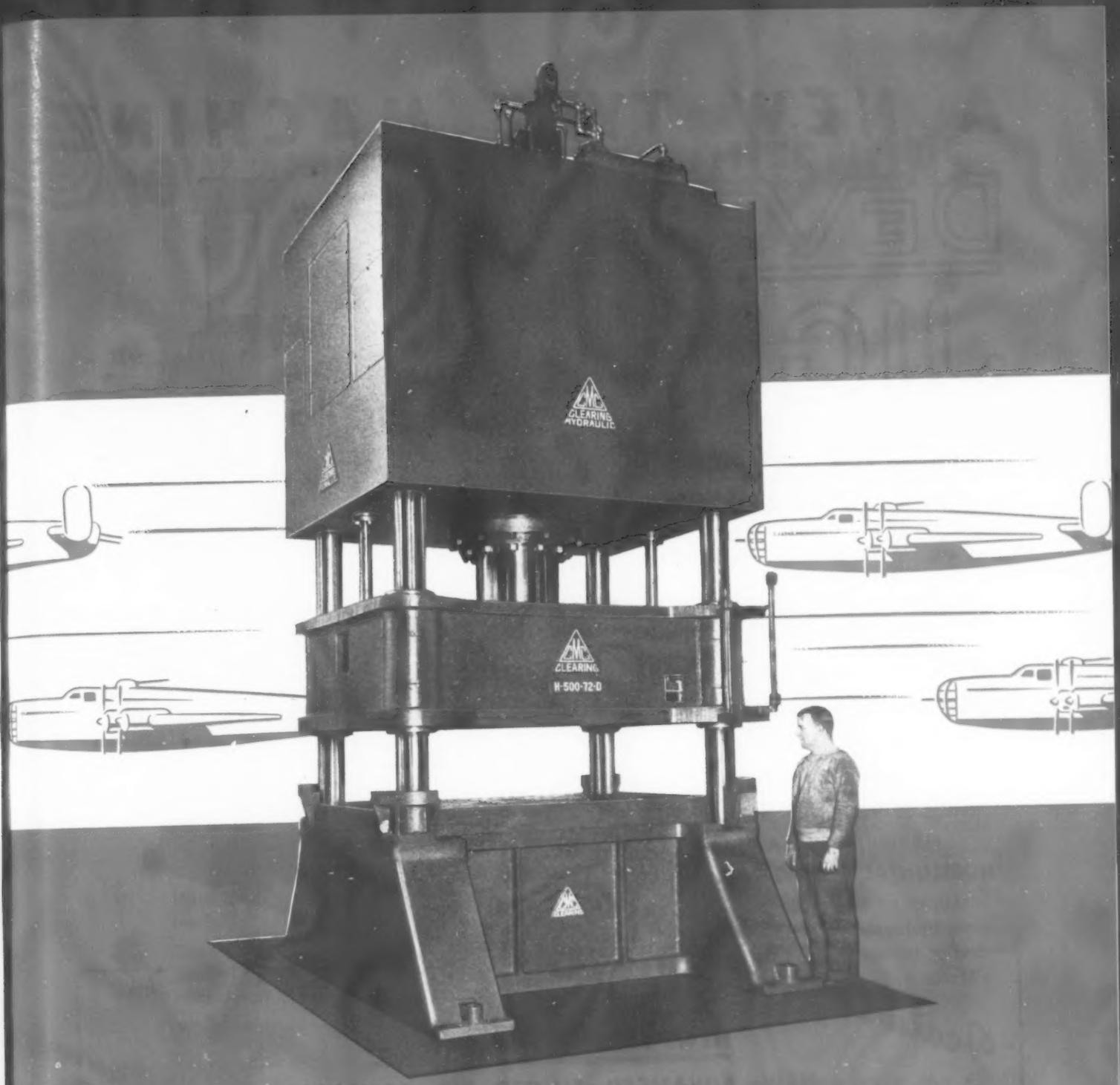
Westinghouse
MANUFACTURING AND REPAIR

J-90453

***IF* THE EQUIPMENT NEEDING MAINTENANCE OR REPAIR IS VITAL TO THE WAR EFFORT ...PHONE OR WIRE THE NEAREST WESTINGHOUSE "M & R" PLANT FOR**

EMERGENCY SERVICE

33 PLANTS . . . ONE NEAR YOU!



CLEARING HYDRAULIC PRESS

Smooth as Silk, in its looks and in its work. This medium size 500 ton CLEARING Hydraulic Press has the same traits as the ever-growing family of CLEARING Hydraulic Presses from the smallest to the largest members. Its smooth, quiet strokes contribute many parts in the building of our country's largest bomber. Installed in plant of a subcontractor, this CLEARING Press has great flexibility, adaptable to a wide variety of work.

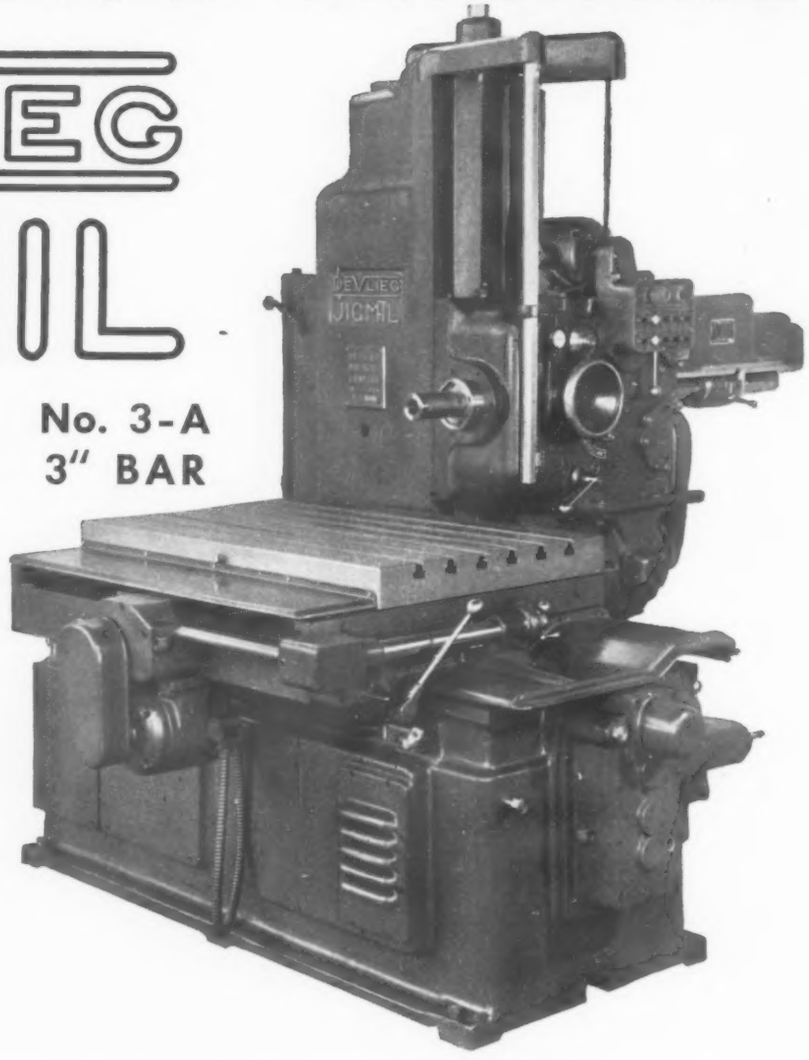
CLEARING MACHINE CORPORATION
6499 West 65th Street, Chicago, Illinois

MECHANICAL AND HYDRAULIC PRESSES

CLEARING
MACHINE CORPORATION
CHICAGO

A NEW TYPE MACHINE

DEVLIEG JIGMIL



No. 3-A
3" BAR

To more accurately and speedily serve the broad field needing a machine having

• • •

THE SPACING ACCURACY OF A JIG BORER

• • •

THE PERFORMANCE QUALITIES OF A MILLING MACHINE

• • •

THE CONVENIENCE AND FLEXIBILITY OF A HORIZONTAL BORING MILL

A PRECISION MACHINE

Featuring

NEW SPEED OF OPERATION

NEW ADVANCED FINGER TIP CONTROLS

NEW STANDARDS OF EXCELLENCE OF BORED HOLES

NEW ACCURACY IN MILLING

AUTOMATIC TABLE RETRACTION AND REPOSITIONING

Many machines in operation show 75% greater average daily productivity and improved dependability for precision.

Write for Circular

DEVLIEG MACHINE COMPANY
450 FAIR AVENUE, FERNDALE (DETROIT), MICHIGAN

DEVLIEG MACHINE TOOLS

HOW MANY OF THESE QUESTIONS CAN *You* ANSWER?

Honing and superfinishing, comparatively new developments in American mechanical practices, have been here long enough for us to fully recognize their great value in high speed production of *efficient* and *dependable* machinery. Every production man knows that.

But, to get the utmost value out of honing, one must understand *proper* honing—the relationship between speed, pressure, grain and grade, metal density, coolant and a dozen other aspects of honing that enter into good manufacturing practices. Not every production man knows that.

How many of these questions, for instance, can YOU answer?

How important is speed in honing?

What are the effects of synchronizing rotational speed with traverse speed?

How important is pressure in honing?

Does the hardness of the abrasive control the degree of pressure necessary?

What controls the selection of coolant in honing operations?

What is the general rule in determining the grain and grade of a stone to be employed on a given metal?

How important is the type of abrasive in honing stones?

How can the difficulties of blind hole honing best be overcome?

Realizing that honing is still too new for production superintendents and shop foremen to know the answers to all such questions the MID-WEST ABRASIVE COMPANY maintains a staff of highly competent engineers—located in all large cities of the United States—who DO know the answers. Any one of them will be glad to work with you in solving any grinding, honing or superfinishing problem confronting you. Please feel free to call upon us—any time. We will be glad to answer any honing questions for you. Let us acquaint you with MID-WEST'S new developments on honing and superfinishing stones, grinding wheels and sandpapers—the world's most *efficient* abrasives.

MID-WEST ABRASIVE COMPANY

Manufacturers of DEPENDABLE Abrasives

1960 E. MILWAUKEE AVENUE DETROIT, MICHIGAN

Mid-West

★ *Honing Stones*

★ *Superfinishing Stones*

★ *Grinding Wheels*

★ *Emery Cloth*

★ *Sandpaper*

Mid-West Abrasive Company,
1960 E. Milwaukee Avenue,
Detroit, Michigan

Gentlemen: Please send me additional information on Mid-West Micro Bond honing and superfinishing stones.

*Name*_____

*Company*_____

*Address*_____

The illustration shows a Fenn Quick-Action Vise holding a part for a well known gun. Fast, accurate handling of small parts such as this can easily be secured with a battery of these vises.

Machining Parts for Famous Guns

We know the Fenn Quick-Action vise is good, for we use it ourselves in our own plant to mill small parts for guns, airplane engines, precision instruments and tool making, where fast handling is important. Its design embodies a quick-locking device, controlled by a cam lever that grips with tremendous power. Grip can be instantly released and the part removed. And just as quickly a new part can be held for the tool operation.

FENN

THE FENN MANUFACTURING CO.

HARTFORD, CONNECTICUT • ESTABLISHED 1900

P&W Photo—Unretouched

but with this difference

This is a taper cutter in the making . . . getting its teeth milled . . . here acquiring what we call "backing off." The angles on these teeth are tremendously important for strength, chip clearance and smooth, accurate cutting ability. Yet you never need worry about them . . . that's our job. We've spent long hours finding out what they should be . . . and we give you the right cutters to do your job.

If you have this P&W taper cutter — or any other P&W small tools, machine tools, or gages — note this: *war production is burdening P&W products with more high-speed, unrelenting work than their purchasers ever expected . . . yet P&W products are standing up in this ordeal, delivering all the accuracy of finished work always associated with this superior line.*

Don't let undue concern for your P&W equipment stand in the way of all-out production. *Don't spare the pressure . . . your P&W tools can take it.*

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD • CONNECTICUT

MARVEL SAWS

MARVEL'S years of Pioneering have given AMERICA the World's Fastest Hack Saws

Thru the years MARVEL engineers have transformed hack sawing from a slow, tedious, "plugging along" operation into a fast, accurate and, when desired, automatic method of cutting-off, and a time-saving means of roughing to size and shape. Today's MARVEL Saws are found not only in well ordered stock rooms but take their place in production lines and tool rooms as well.

As a prerequisite to modern high speed metal sawing, MARVEL developed the first positively unbreakable high speed hack saw blade—a composite blade that combined the toughness of its alloy steel body with the cutting quality of its high speed edge. Then with a saw blade that could stand up indefinitely under any speed, feed and tension, MARVEL began the development and manufacture of the first truly high speed hack saws and the first "self-feeding" hack saws with automatic bar push-ups.

Then came the modern heavy-duty, all ball-bearing MARVEL 6A and 9A Production Hack Saws that are doing so much to speed up America's War Program, and the giant No. 18 MARVEL Hydraulic Hack Saw that accurately cuts off the largest sizes and toughest steels easily and speedily. These, with the versatile MARVEL No. 8 Band Saw, which makes an unlimited variety of cuts, are found "holding their sector" in almost every war production line.

Wherever "maximum speed" and ultimate reliability are required for war production jobs, you are almost certain to find that the metal sawing machines are MARVELS.

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Ave. **Chicago, U.S.A.**

Eastern Sales: 225 Lafayette St., New York

RIVETT

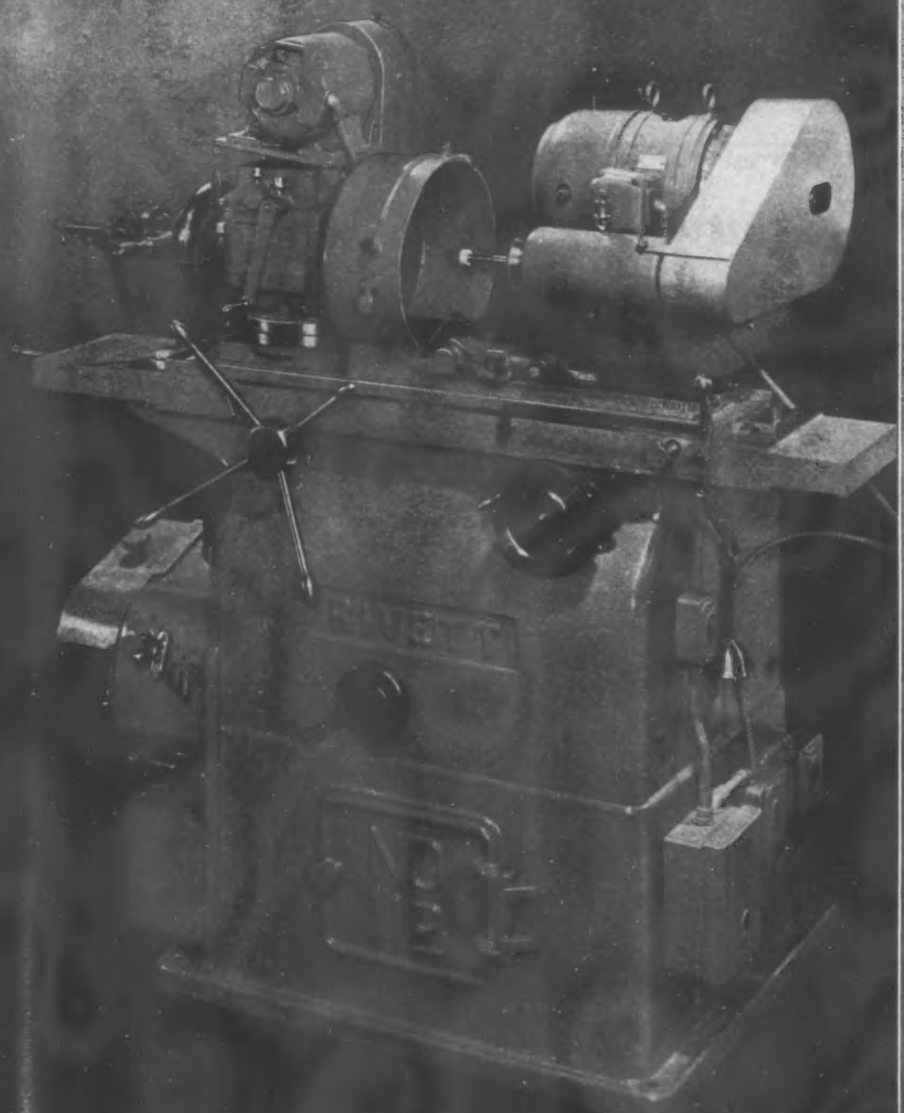
112 UNIVERSAL GRINDER

For Straight, Taper, Bevel or Straight and Bevel Grinding

The Rivett No. 112 Universal Precision Grinder is primarily for tool-room work. Available internal and external spindles in combination with many adjustments make possible a great variety of grinding operations. Extreme simplicity of design enables any mechanic familiar with grinding to operate the machine.

Work may be held in collet, step chuck, jaw chuck or fixture and driven at required speed. Power table reciprocation may be set at one of eighteen selective speeds, from 10 to 86 passes per minute. Length of table travel is [illegible] between ½" and 8". High or low speed internal spindle bracket or external spindle bracket, all as illustrated, may be [illegible] as required on cross slide. Workhead, table and cross slide are swivelled individually or in combination for taper and bevel grinding.

ARMY NAVY



High Speed Internal Spindle

External Spindle and Tailstock

SPECIFICATIONS

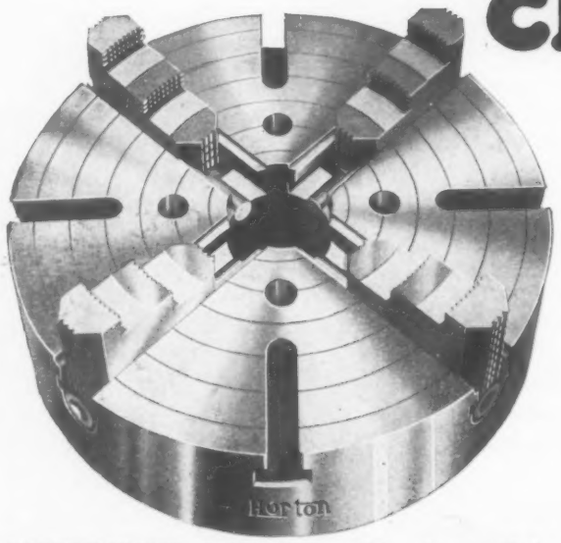
Grinding cap., hole dia.	⅛" to 8"
Grinding cap., outside dia.	up to 8"
Automatic table travel	½" to 8"
Table speeds	18 selective
Hand table travel	16"
Swing over table	14"
Workhead swivel	90°
Table swivel	5°
Cross slide swivel	30°
Cross feed graduations	.0005"
Travel of cross slide	3½"
Collet capacity	1"
Step chuck capacity	8"
Jaw chuck capacity	8"
Workhead spindle speeds	150, 380, 600 r.p.m.
Grinding spindle speeds:	
Standard int.	4600 and 10000 r.p.m.
High speed int.	25000 r.p.m.
External	3300 r.p.m.
Automatic Oil Lubrication	
Net weight with motors	3700 lbs.

For Further Description Write for Bulletin 112

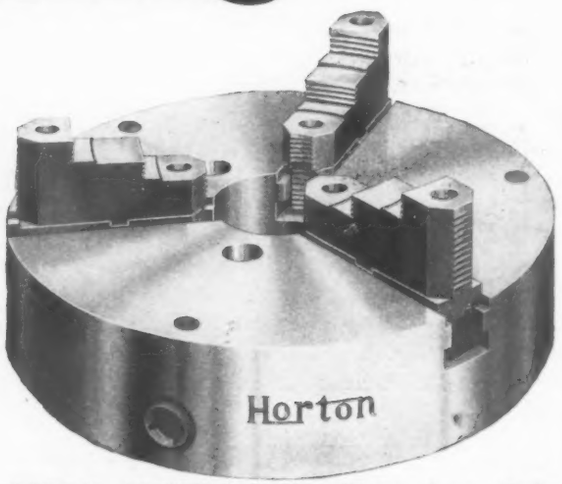
112 UNIVERSAL GRINDER

RIVETT LATHE & GRINDER INC.
BRIGHTON, BOSTON, MASS.
PIONEERS IN BENCH LATHE DEVELOPMENT

Horton chucks



INDEPENDENT Solid Reversible Jaws Only



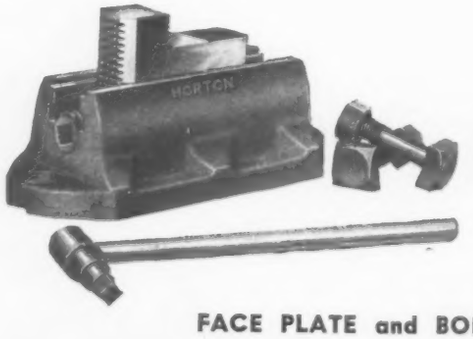
SCROLL UNIVERSAL Two-Piece Jaws Only

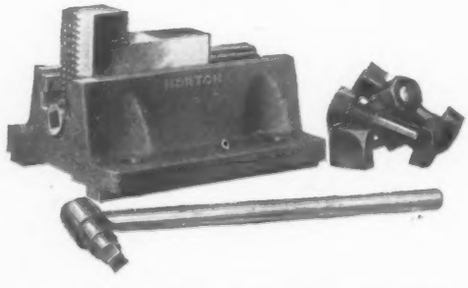
For Use With Intermediate Plates On Threaded Spindles

For Key Drive Tapered Nose Spindles

War Production
Limited To These
Essential Chucks

For Flanged Tapered Nose Spindles
Illustration shows chuck for Type D (Cam Lock) Spindle





FACE PLATE and BORING MILL JAWS—Steel Body Only

HORTON
MORROW

SINCE 1851 ....THE E. HORTON & SON CO.
WINDSOR LOCKS, CONNECTICUT, U. S. A.

"MY MAN FRIDAY
. . . Every Day in the Week"

More pieces faster, in less time with less space and waste.

Wide ranges of feed and speed.

Heavy, rigid slide supports for heavier forming cuts.

Cams on one camshaft above working area — free from falling chips, oil and grit.

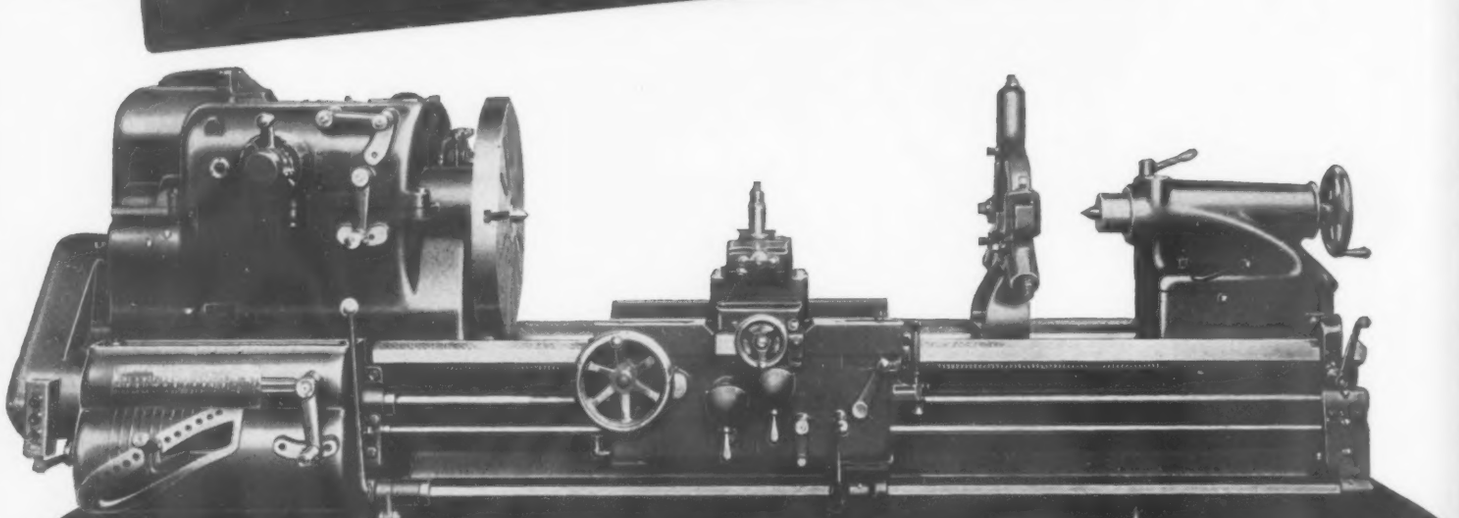
Tooling area, cams and controls convenient to operator from either side of the machine.

It pays to specify Cones; wire, phone or write for particulars.

4, 6 and 8 Spindle Automatic Bar Machines

CONE AUTOMATIC MACHINE CO., INC.
WINDSOR, VERMONT, U. S. A.

FOR WAR PRODUCTION



SPRINGFIELD

Geared Head Lathes

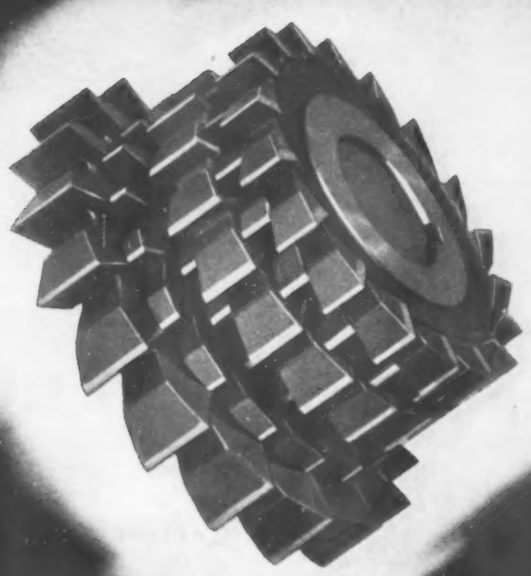
● In the Machine Tool industry's current expansion program to increase production, SPRINGFIELD Geared Head Lathes are playing a prominent role . . . in ever greater numbers, SPRINGFIELDS are being tagged "FOR WAR PRODUCTION". In turn, this demand has caused us to expand our own facilities and services to turn out more lathes, so that more guns, tanks, airplanes and other fighting tools can be economically and efficiently produced. As always, those saving features of SPRINGFIELD Geared Head Lathes—maximum gearing efficiency . . . ingenious attachments . . . rugged construction . . . superior lubricating and power transmission systems, and many more — are showing themselves to be the answer to many problems, particularly where sustained production is the order of the day. For War Production now, and normal operations later, choose SPRINGFIELD — Geared Head Lathes in sizes from 14" to 30". Write for circular #162, concerning prices, delivery dates, etc.

The SPRINGFIELD MACHINE TOOL Co.

SPRINGFIELD OHIO U.S.A.

"SPECIALS" On Time

SPECIAL PRECISION CUTTERS OF HIGH-SPEED STEEL
for
AIRCRAFT — GUN — WAR INDUSTRIES



To meet the demands of the war program — ON TIME — C & W is constantly expanding plant capacity. C & W is one of the largest producers of special high-speed precision cutting tools — and has an outstanding record in meeting promised delivery schedules.

Write for illustrated pamphlet — Consult us on your tool requirements

Reamers
End Mills
Counterbores
Profile Cutters
Hollow Mills
Shaving Tools
Interlocking Cutters
Tapered Reamers
Gun Drills
Countersinks
Milling Cutters

C & W TOOL COMPANY

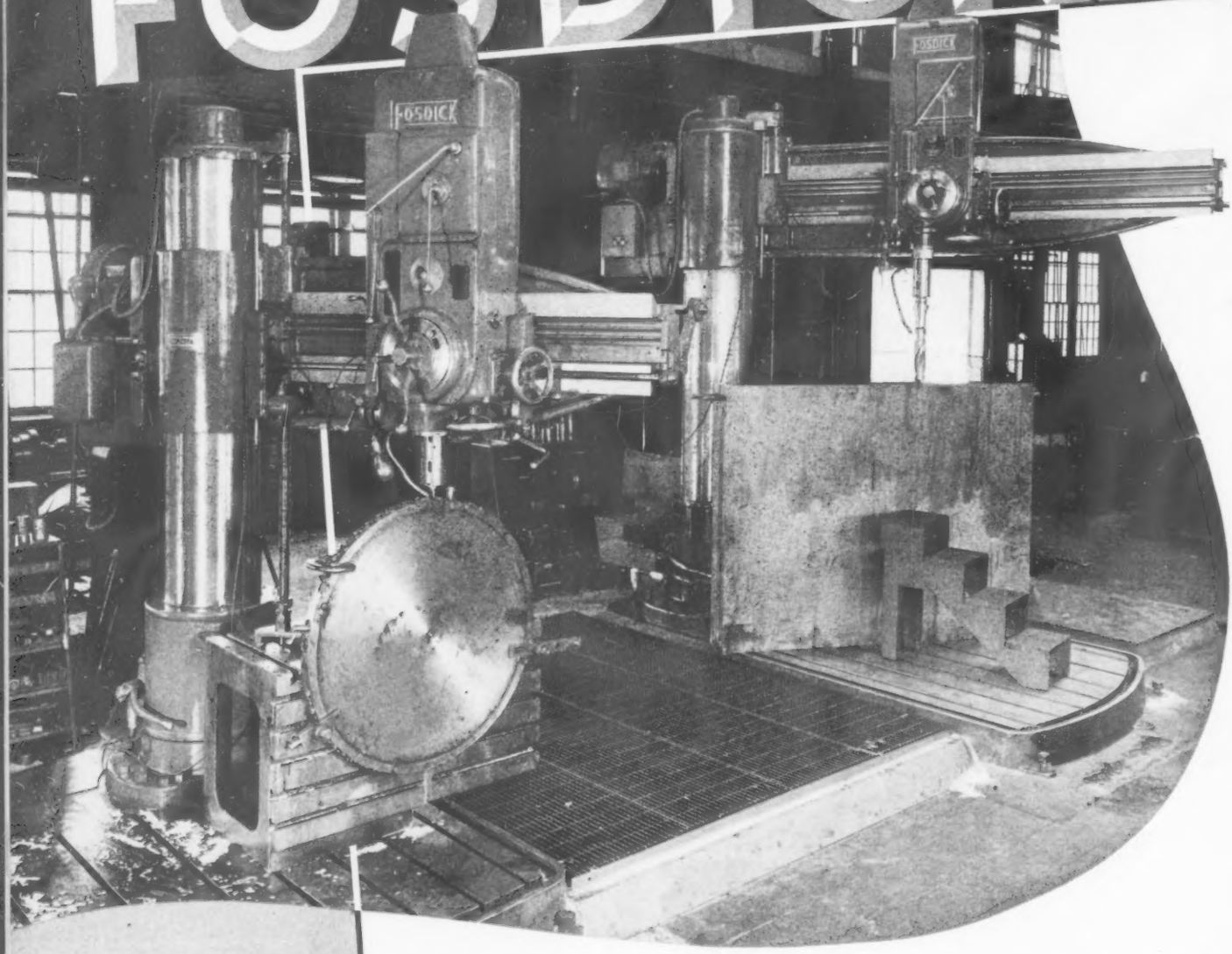
19 Chestnut Street, Cambridge, Massachusetts

NEW YORK PHILADELPHIA DETROIT

C&W TOOLS

FOR OVER 30 YEARS — QUALITY PRECISION CUTTING TOOLS

FOSDICK



BUILT IN SIX CAPACITIES

From 3 foot up to 8 foot inclusive!

CUTTING SPEED CHART
DRILL DIAMETER
INCHES
SFM
RPM
FOR LARGER DRILLS THAN 3 INCHES TURN DIAL TO ONE HALF OF DIAMETER WANTED THEN DIVIDE R P M BY 2
USE COOLANT WHEN NECESSARY
THE FOSDICK MACH. TOOL CO.
CINCINNATI, OHIO, U.S.A.

IT'S EASY TO SELECT THE CORRECT SPEED FOR VARIOUS METALS

ECONOMAX *Hydraulic* RADIALS

meet demands for flexibility on WAR Contracts . . .

Today with every available plant doing its best to meet war time schedules the flexibility of Fosdick Radials is a point of extreme significance.

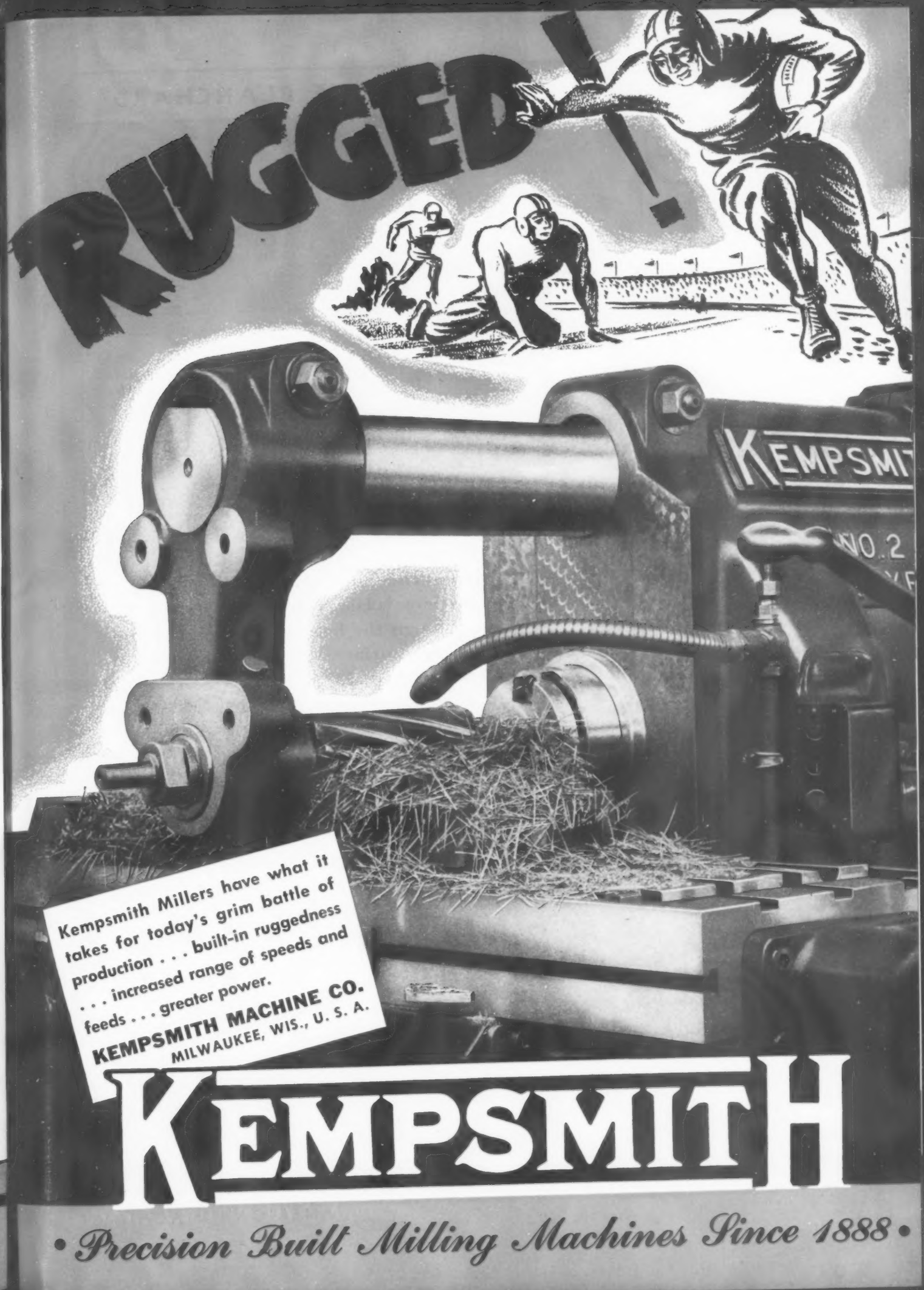
In this machine shop two Fosdick Radials are working on two distinctly different jobs yet the results in terms of production — accuracy — low costs are identical due to their extreme versatility and ease of operation.

Thirty-six spindle speeds — eighteen feeds compactly built into the head make possible a particularly wide range of operations. The centralized location of the speed and feed change levers make for ease of operation and high production.

Another point of construction on which users comment is the large diameter column and wide sturdy arm which eliminate any tendency to deflect under heavy load and insures constant accuracy of work.

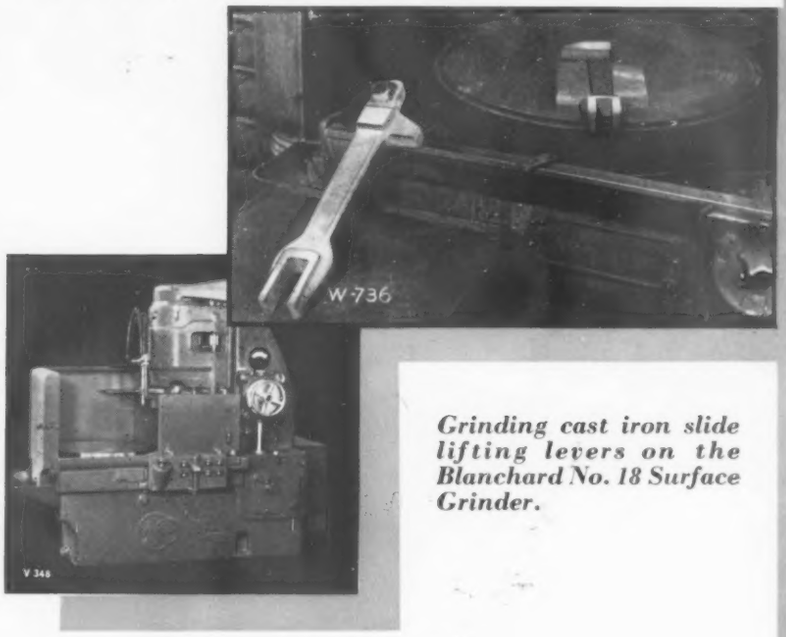
Put your Radial work on a Fosdick Economax and enjoy its many advantages in operating economy. Fosdick Radial Bulletin RA gives complete details. Write for yours.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI . . . OHIO


RUGGED!
KEMPSMIT
NO. 2
Kempsmith Millers have what it takes for today's grim battle of production . . . built-in ruggedness . . . increased range of speeds and feeds . . . greater power.
KEMPSMITH MACHINE CO.
MILWAUKEE, WIS., U. S. A.
KEMPSMITH
• Precision Built Milling Machines Since 1888 •

BLANCHARD

"PUT IT ON THE BLANCHARD"



Grinding cast iron slide lifting levers on the Blanchard No. 18 Surface Grinder.

CHECK THESE ADVANTAGES OF BLANCHARD GRINDING

- Production
- ★ Adaptability
- ★ Fixture Saving
- Operation Saving
- Material Saving
- Fine Finish
- Flatness
- Close Limits

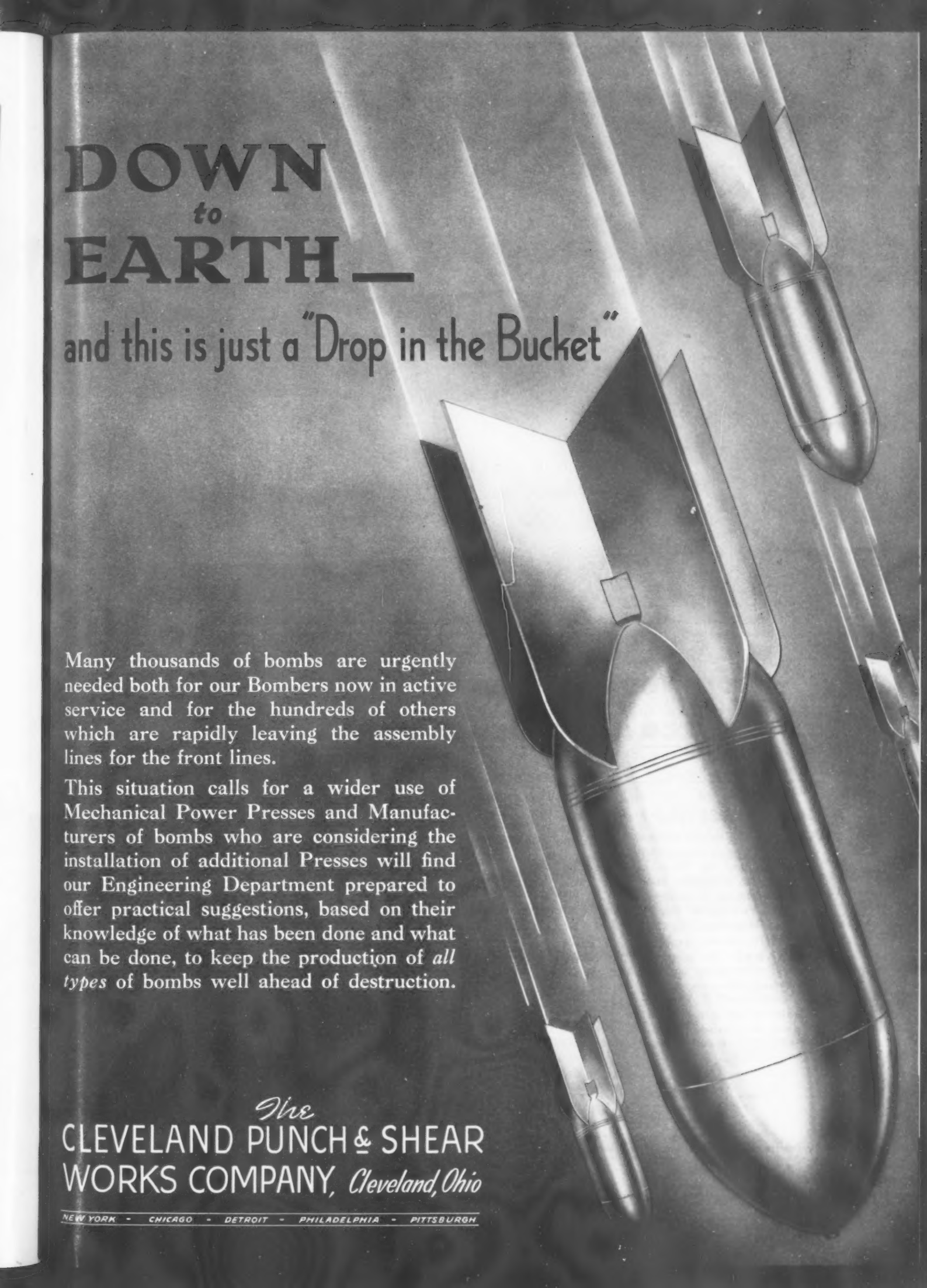
★ . . . . . *Especially valuable on jobs like the one illustrated.*

AT FIRST GLANCE this does not look like a job for the Blanchard No. 18 on account of the projecting boss. The problem was solved simply enough. The lever is laid on the chuck so that the boss goes through the hole in the center of the chuck. The outer surface, which is lower than the inner surface, is ground. The wheel is then raised, the chuck moved in, and the inner surface is ground. The lever is then turned over and a .290″ size block is placed under the ground forked end to make it level with the other end, and both surfaces are finished.

3/16″ of stock is ground off each side to limits of +.002″. 8 pieces (16 surfaces) are ground per hour.

The BLANCHARD
MACHINE COMPANY
64 STATE STREET, CAMBRIDGE, MASS.

Send for your free copy of "Work Done on the Blanchard." This book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.



DOWN to EARTH—

and this is just a "Drop in the Bucket"

Many thousands of bombs are urgently needed both for our Bombers now in active service and for the hundreds of others which are rapidly leaving the assembly lines for the front lines.

This situation calls for a wider use of Mechanical Power Presses and Manufacturers of bombs who are considering the installation of additional Presses will find our Engineering Department prepared to offer practical suggestions, based on their knowledge of what has been done and what can be done, to keep the production of *all types* of bombs well ahead of destruction.

The
CLEVELAND PUNCH & SHEAR
WORKS COMPANY, *Cleveland, Ohio*

NEW YORK - CHICAGO - DETROIT - PHILADELPHIA - PITTSBURGH

OPM Photo by Hollem

NOW YOU MUST LEARN *"HOW-TO-DO-IT"* BETTER..CHEAPER..WITHOUT WASTE

CAN YOU USE HELP?

We have available a new motion picture and a booklet (soon off the press), both on "*Stainless Steel Welding.*" Also for your production men, a complete "*Handbook of Special Steels.*" For your engineers, certified "*Blue Sheets*" on each tool and stainless grade. For your apprentice or training courses, "*Elementary Discussions on Tool and Stainless Steels.*"

● Write for the informational help you need. In addition, the personal assistance of our Technical Staff is at your call.

PRODUCING constantly improved war goods at a diminishing rate of cost, and an increasing rate of speed, ordinarily wouldn't be much of a trick for America. It's right up our industrial alley.

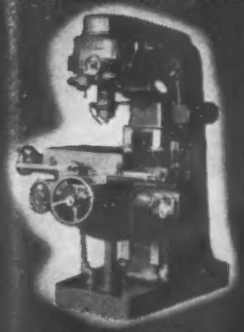
But conditions today are not as usual. There is no inexhaustible ocean of materials. There is, instead, a controlled stream flowing through rigidly restricted channels. We have to do *more*, actually, with *less.*

Thrift is especially essential with the vital steel alloys. If you use alloy steels in *any* form, check your dies, your cutting tools and machine set-ups, your heat-treat and welding methods—check and recheck every operation to reduce rejects, spoilage, undue scrap, or any other form of waste. Above all, carefully segregate and classify your unavoidable alloy steel scrap (*that is the only way the mills can reclaim it*) and rush it back into the useful cycle.

Allegheny Ludlum
STEEL CORPORATION
GENERAL OFFICES: PITTSBURGH, PENNSYLVANIA

A-8665-1

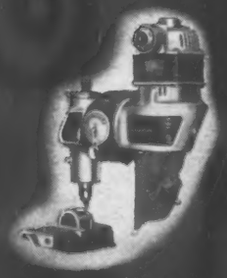
Machines, Accessories and Attachments for a Wide Variety of Needs:



Rotary Head Milling Machine

Autometric Jig Boring Machine

Milwaukee Midgetmill



Milwaukee Speedmill

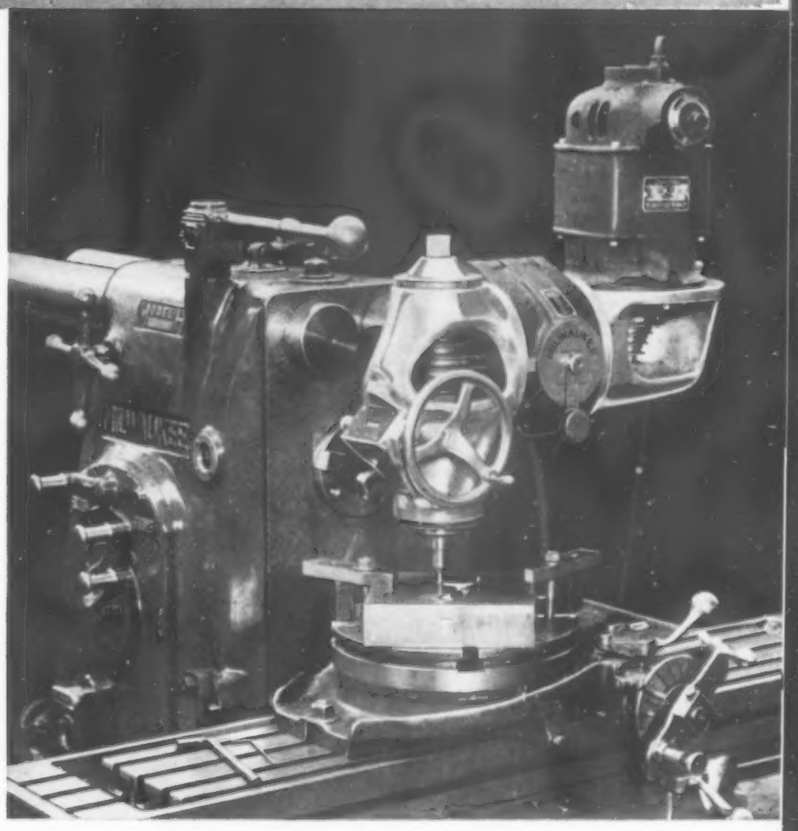
Milwaukee Face Mill Grinder

Center Scope

2 REASONS WHY MOLD AND DIE MAKERS PREFER THE MILWAUKEE MIDGET MILL

1- EXTREME SMOOTHNESS OF CUTTER OPERATION

2- MINIMUM CUTTER BREAKAGE



THE Midgetmill is designed to get the most from small tools by providing the necessary high speeds to assure accurate, trouble-free performance on the production of dies, molds, metal patterns and templets. Its unusual stability means extreme smoothness of cutter operation and a minimum of cutter breakage.

The completely universal feature, swiveling either toward or away from the column face in either direction, extends the versatility and flexibility of this attachment to hundreds of applications, including a wide variety of angular milling, drilling and horizontal boring operations.

The Midgetmill is equipped with a Thou-Meter which registers in thousandths instantaneously, eliminating costly errors. It has no graduations, dials, stops, counting turns or binding screws. One or more Midgetmills in your shop will help you to keep in step with today's demand for high speed tool and die making and other precision machining.

★ ★ ★

Write for Bulletin 662 C and information on the Milwaukee Midgetmill, the high-speed attachment adaptable to any milling machine.

KEARNEY & TRECKER PRODUCTS CORPORATION
Milwaukee, Wisconsin

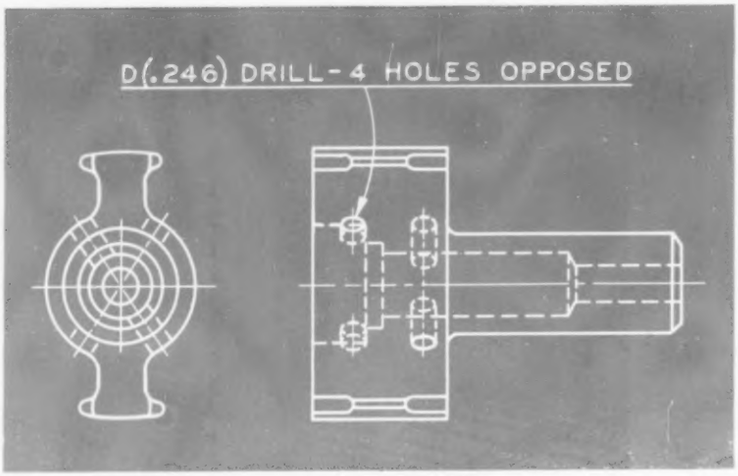
Kearney & Trecker Products CORPORATION
Subsidiary of Kearney & Trecker Corporation

There are 2 ways to do this job—

1. The EXPENSIVE WAY... *or*

2. The FLEXIMATIC

by KINGSBURY

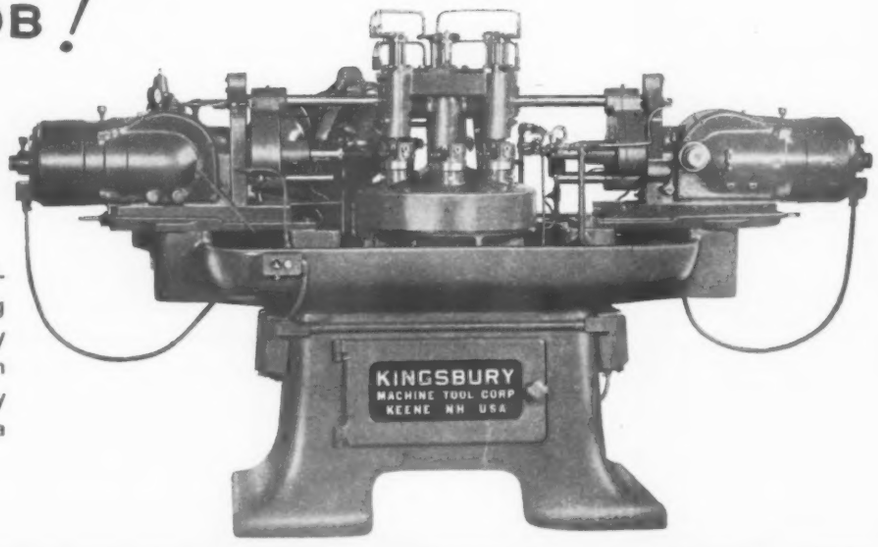


WAY

The expensive way to drill the four opposed holes in this shock absorber part would be to use a general-purpose drilling machine. Production would be limited to one hole at a time and by operator skill in manual indexing, etc.

The FLEXIMATIC way uses standard Units set up on a standard base around an automatically indexing turret. The only manual operations are loading and unloading, and even as these are being performed the Units are drilling work already loaded.

FLEXIMATICS combine the speed and efficiency of a special purpose machine with the valuable advantages obtained by their flexible set-up.



Standard Kingsbury Units for drilling, reaming, boring, spot facing and many milling operations may be mounted in any combination on standard bases and readily changed over to manufacture a wide variety of parts.

KINGSBURY MACHINE TOOL CORPORATION

KEENE NEW HAMPSHIRE U.S.A.

18,400 spot welds in 7½ HOURS --on aluminum alloys

Typical installation of a Sciaky resistance-welding machine with G-E rectifier control which has enabled the Glenn L. Martin Company to make as many as 18,400 spot welds in 7½ hours

GET CONSISTENT, HIGH PRODUCTION WITH G-E IGNITRON RECTIFIERS

on inductive-type stored-energy welding

PROVED by more than 18 months of actual use in supplying power to inductive-type, stored-energy welding machines, G-E ignitron rectifiers are helping users get fast, dependable operation—particularly in the aircraft industry.

Because of its low kva demand, the inductive type of stored-energy resistance welding permits the use of low-cost plant distribution systems and reduces voltage drop. It also permits installation of welding machines at the most favorable point in the production line—even though this may be at some distance from the distribution transformers.

Good voltage regulation afforded by the low kva demand also reduces the possibility of light flicker and limits interference with other welding equipment on the same circuit.

Designed by outstanding electronics engineers, these G-E rectifiers are built for ease of installation and low maintenance. Whatever your problems on control for resistance welding — consult your nearest G-E office. Our control specialist will be glad to work with you. *General Electric, Schenectady, N. Y.*

General Electric and its employees are proud of the Navy award of Excellence made to its Erie Works for the manufacture of naval ordnance.

GENERAL ELECTRIC

Takes 'em up—
Brings 'em down
on Wheels
Turned on

KING Vertical Boring and Turning Machine

This 30" single column King Vertical Boring and Turning machine is one of a battery in a large mid-west plant speeding landing wheels to airplanes for our many fronts.

The machine is now boring the inner hub and also turns the brake drums on the outside of the wheel without resetting. Close tolerances are maintained and the wheels are being turned out at a high production rate.

Full electric control to turret and side head not only facilitates operation but insures exact duplication of work.

Put your boring, turning and similar operations on a KING Vertical Boring Mill for more work—greater accuracy—lower costs.

KING
MACHINE TOOL CO.

KING BUILDS

King Vertical Boring and Turning Machines are built in single column types from 30" to 42" and double column up to 10 feet.

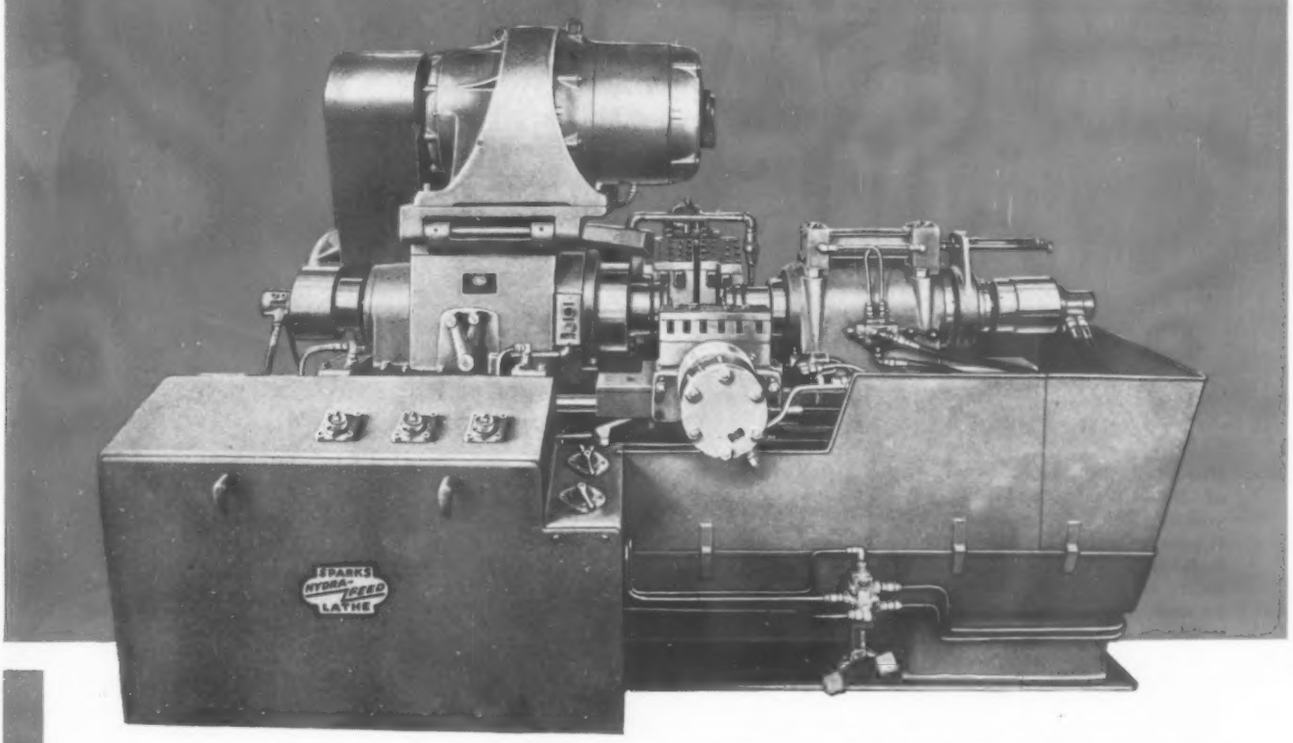
The KING MACHINE TOOL Company

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY

CINCINNATI, OHIO

ANNOUNCING

THE New SPARKS SEMI-AUTOMATIC TURNING LATHE



FOR HEAVY-DUTY AIRPLANE CYLINDER PRODUCTION

Write today for Descriptive Bulletin giving full information

This recently developed multi-tool machine for turning heavy airplane cylinders has been proved highly productive in actual performance.

It is arranged to accommodate six turning tools on the front cross slide for main body turning and employs a hydraulically operated cartridge tool holder mounted on cross slide. Six tools are also mounted on back slide which also moves in and out of the work automatically. The cylinder is gripped on both ends by a specially designed holding mandrel.

A roller-bearing quill expanding arbor, attached and fitted to quill, is expanded automatically by separate hydraulic cylinder. Quill is traversed backward and forward by connection to hydraulic cylinder mounted on top of tailstock.

All feeds are controlled through conveniently located metering valves on front of machine. Holding equipment is operated through a foot treadle valve on front of machine and permits quick recovery of finished cylinder as well as rapid gripping of rough cylinder about to be turned.

Headstock, roller and ball bearing equipped throughout, provides four selective speeds for turning various size airplane cylinders. A reducing gear motor makes it possible to bring speeds down for turning cylinders of exceptionally hard material.

SPARKS HYDRA-FEED LATHE

SPARKS MACHINE TOOL CORPORATION
NORWALK . . . . CONN.

Grind Quicker... Grind Smoother

ON EVERY WAR-TIME JOB WITH THESE

SKILSAW TOOLS!

NEW!

SKILSAW PORTABLE GRINDERS

Just introduced to speed up production on every war-time job...grinding down rough welds, smoothing welding beads, cleaning metals, filing, buffing and polishing on every metal surface. Two Models.

Here are FIVE kinds of SKILSAW TOOLS you shouldn't be without, if you want to *speed* your finishing operations, *reduce* waste and *increase* your output in war production. Do you have welds to grind down? Stainless steel or brass sheets to polish? Castings to clean? Small machine parts to finish? There's a SKILSAW TOOL for each of these operations . . . and the job will get done quicker and better and at lower cost.

These SKILSAW GRINDERS and SANDERS are typical of the entire line of SKILSAW TOOLS—designed to deliver results under today's stepped-up conditions, built to stand hard usage without time-wasting breakdowns. Look into America's busiest war-work plants and you'll see SKILSAW TOOLS on the job. Ask your distributor for a demonstration and you'll see why!

SKILSAW PORTABLE ELECTRIC TOOLS

★ MAKE AMERICA'S HANDS MORE PRODUCTIVE ★

SKILSAW, INC.
5059 Elston Avenue, Chicago

New York • Boston • Buffalo • Philadelphia • Cleveland • Detroit
Indianapolis • St. Louis • Kansas City • Atlanta • New Orleans
Dallas • Los Angeles • Oakland • Seattle • Toronto, Canada

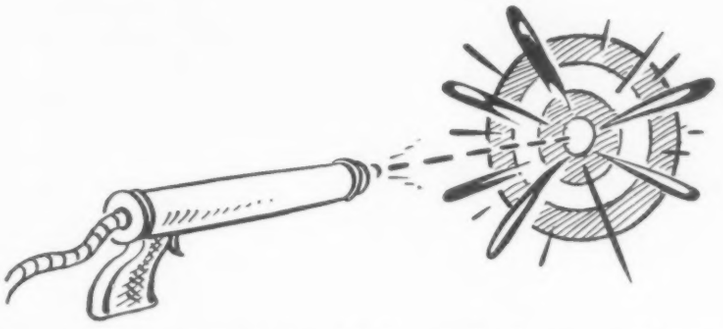
Sanding stainless steel to a perfect finish is faster with SKILSAW Disc Sanders. Also remove waste metal, buff and polish on flat or curved surfaces.

SKILSAW Belt Sanders speed up all "final-finishing" on flat surfaces of bronze, brass and all sheet metals. Quickly remove paint and varnish.

SKILSAW Hand Grinders are swifter, better on all grinding of jigs, dies and for precise finishing on intricate machines and castings.

Spotted conveniently throughout the plant, SKILSAW Bench Grinders speed production, keep tools and twist drills sharper . . . grind small parts quicker.

Among the Big Guns OF THIS WAR is the Grease Gun!



EVERY LUBRICATION JOB should be a bullseye today — enough lubricant, not too much. With anti-friction bearings, remember grease guards the steel rolling elements primarily against *corrosion,* not friction. Too much grease only *promotes* heat!

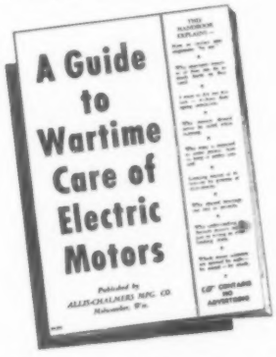
AS LONG AS oil prevents metal-to-metal contact in sleeve bearings, wear is impossible — *if no grit is present!* Thus it pays to keep oil covers tight, dust seals in good condition.

AN OIL FILM often is no thicker than the wall of a soap bubble — can fail just as suddenly *and completely*. To protect it, maintenance guards against pressures from misalignment.

MAINTENANCE IS IN THIS WAR WITH EVERYTHING IT'S GOT—AND THAT'S *PLENTY!* FOR EXAMPLE—HERE ARE WAYS PROPER CARE OF MOTORS HELPS INSURE FULL—*AND CONTINUED*—U. S. PRODUCTION!

FINER lubrication than ever is vital today — but it's only *one* method used by maintenance to step up the wartime efficiency of motors.

Fighting dust, moisture and stray oil is important, too — and all such means of safeguarding motors are presented in Allis-Chalmers' new maintenance handbook . . .



"A Guide to Wartime Care of Electric Motors" describes all nine main motor enemies in detail — tells how to fight each of them.

It's fully illustrated — applies to *all* standard makes of general-purpose motors — contains no advertising. Write now for *your* free copy. ALLIS-CHALMERS MFG. CO., MILWAUKEE.

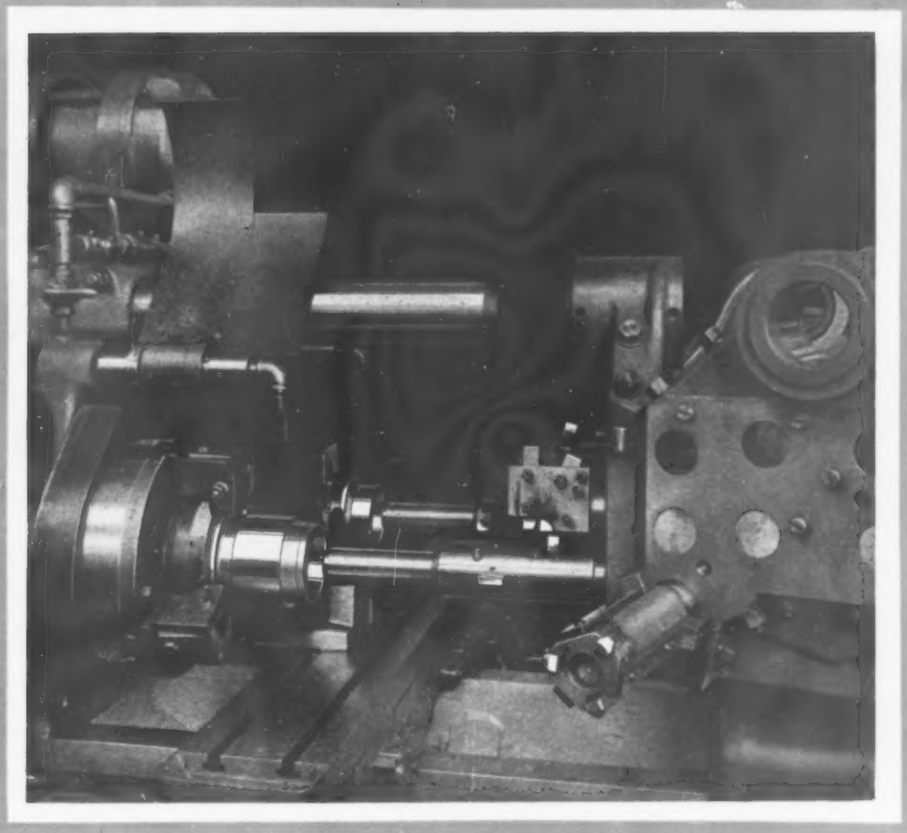
A-1552

ALLIS-CHALMERS

WE WORK FOR VICTORY — WE PLAN FOR PEACE

VICT

—WITH POTTER



P & J *Methods assure full War-time* SPEED

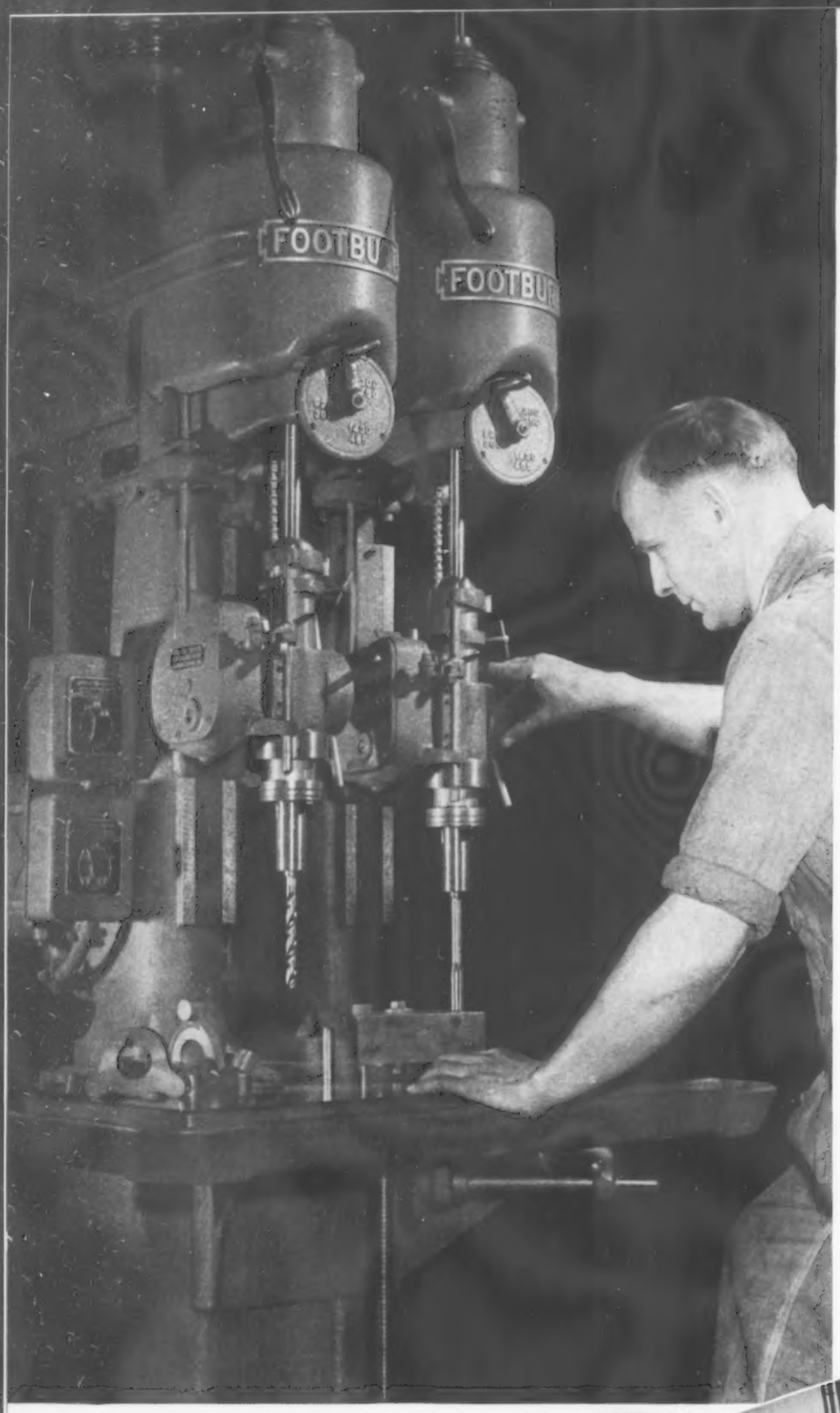
The above action close-up of a P&J 5D two spindle Automatic shows clearly how war-time speed is applied to the production of Aircraft Cylinder Barrels. All surfaces, except the fins, are machined to typically close aircraft tolerances. Note the two spindles: tooling for the first is for internal operations, the second for external operations. Both operations are performed simultaneously—in incredibly fast floor-to-floor time.

P&J methods for machining aircraft engine cylinders have been varied to suit individual requirements. This particular set-up represents a real accomplishment; flexibility, ease of changeover to meet design alterations, minimum floor space, low power consumption, rigidity, high finish accuracy, and low initial investment are all combined to a degree never before attained on this class of work. Incidentally, one operator readily handles three P&J 5D two spindle Automatics on this job.

POTTER & JOHNSTON MACHINE COMPANY, PAWTUCKET, RHODE ISLAND

ORY

& JOHNSTON AUTOMATICS!



THE *Sensitive Drill* FOR WAR WORK

★ The choice of fine machine tools now will help you meet those new production schedules needed to win the war. • Footburt sensitives are built with the wide range of speeds and with the power and sturdiness to drive cutting tools to their full capacity. They are built with the care and precision that will keep them accurate over a long period. • Write, wire or phone for prices and delivery information.

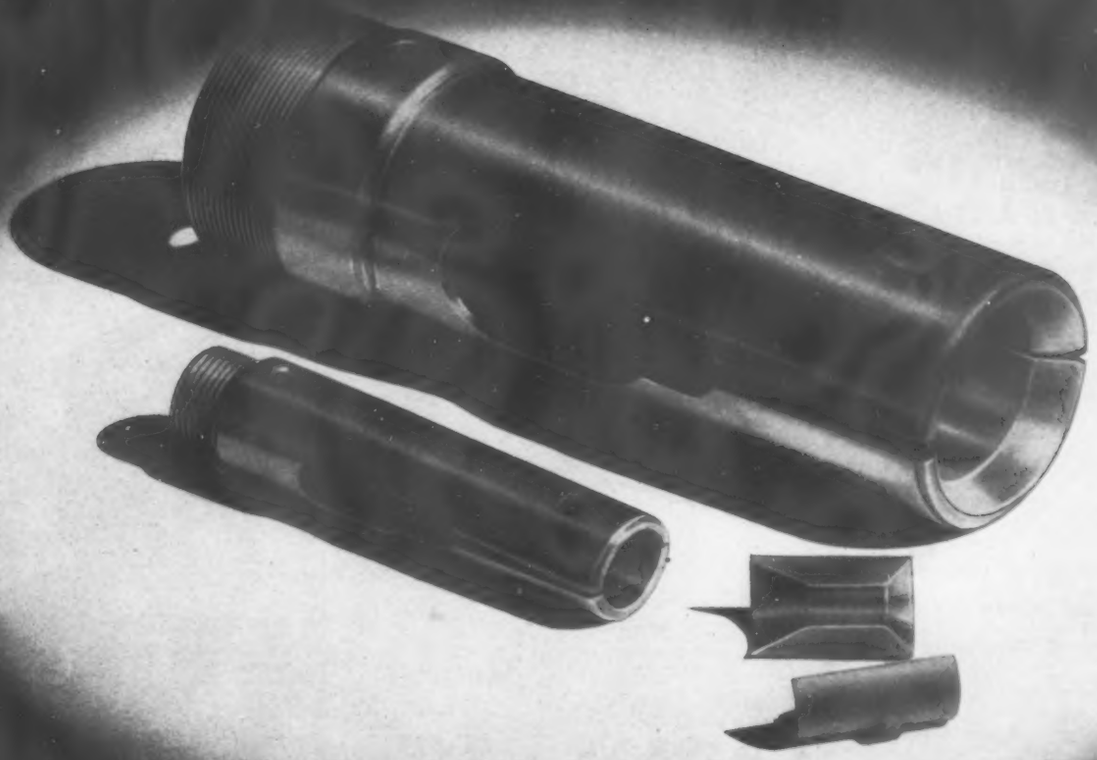
THE FOOTE-BURT COMPANY
CLEVELAND, OHIO
Detroit Office: General Motors Building

FOOTBURT *Sensitive* **DRILLING MACHINES**

HARDINGE

Style "B"

Master Feed Fingers and Replaceable Pads



Save Material

The change-over to a new size or to renew the same size involves inexpensive pads only instead of expensive solid feed fingers.

Today this saving is more important than ever before as the economy not only saves money for you, but also conserves steel which is of vital importance.

Many other advantages of using HARDINGE Style "B" Master Feed Fingers with either steel, bronze or nickel cast iron pads will be immediately appreciated when you put them into use.

Learn all the advantages by asking for this illustrated bulletin containing complete information. Available to purchasing agents, superintendents, foremen, engineers, set-up men and operators in organizations which have a screw machine department.

HARDINGE BROTHERS, Inc., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

CINCINNATI Hypro

72" DOUBLE HOUSING PLANER

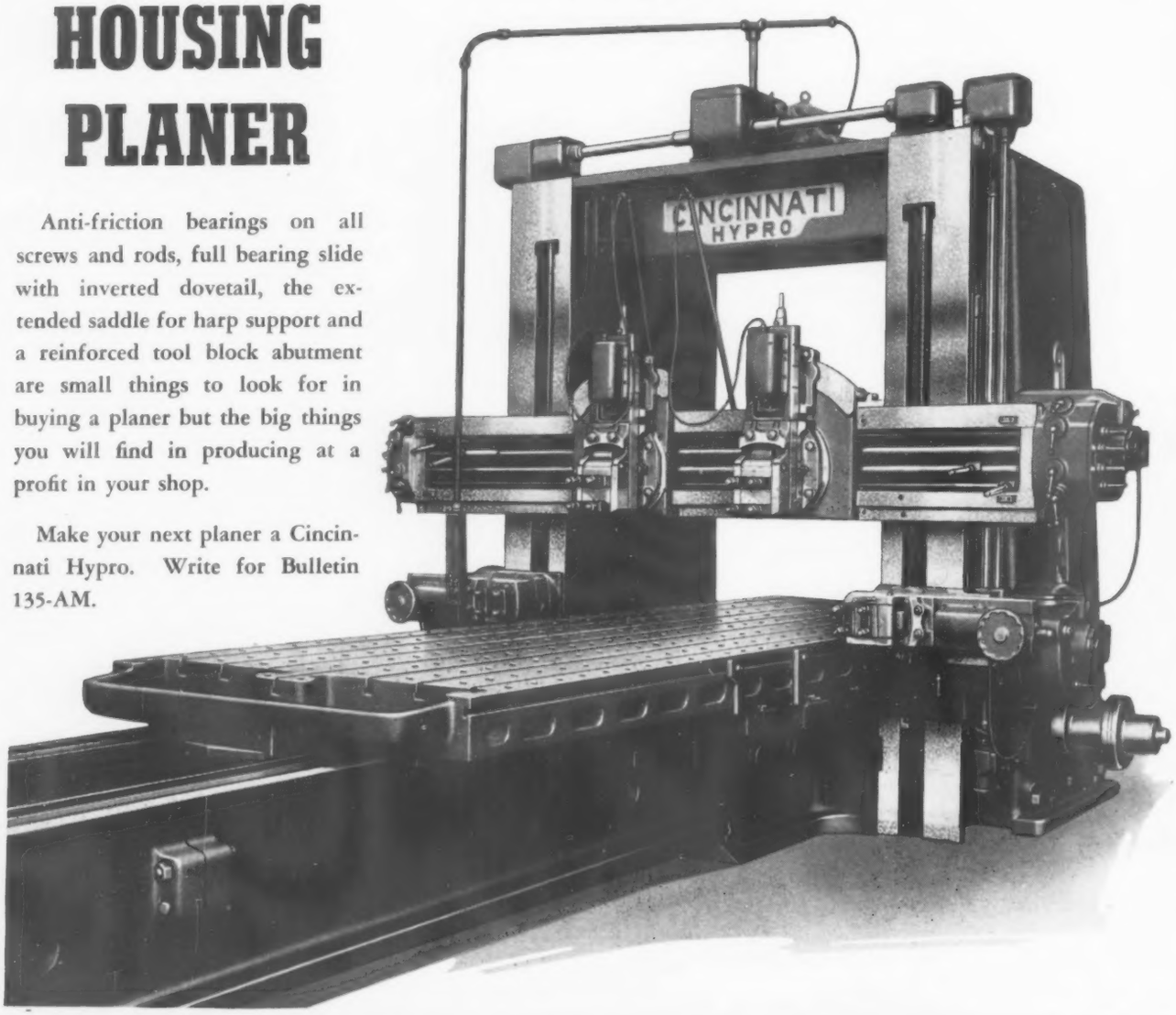
When you buy a Cincinnati Hypro Double Housing Planer you get the best features developed for accurate work, fast operation and profitable results.

The all steel herringbone gearing, including the bull gear and the rack, provide smooth even flow of power to the table. It is a balanced drive free from any loss or wear due to side pressures.

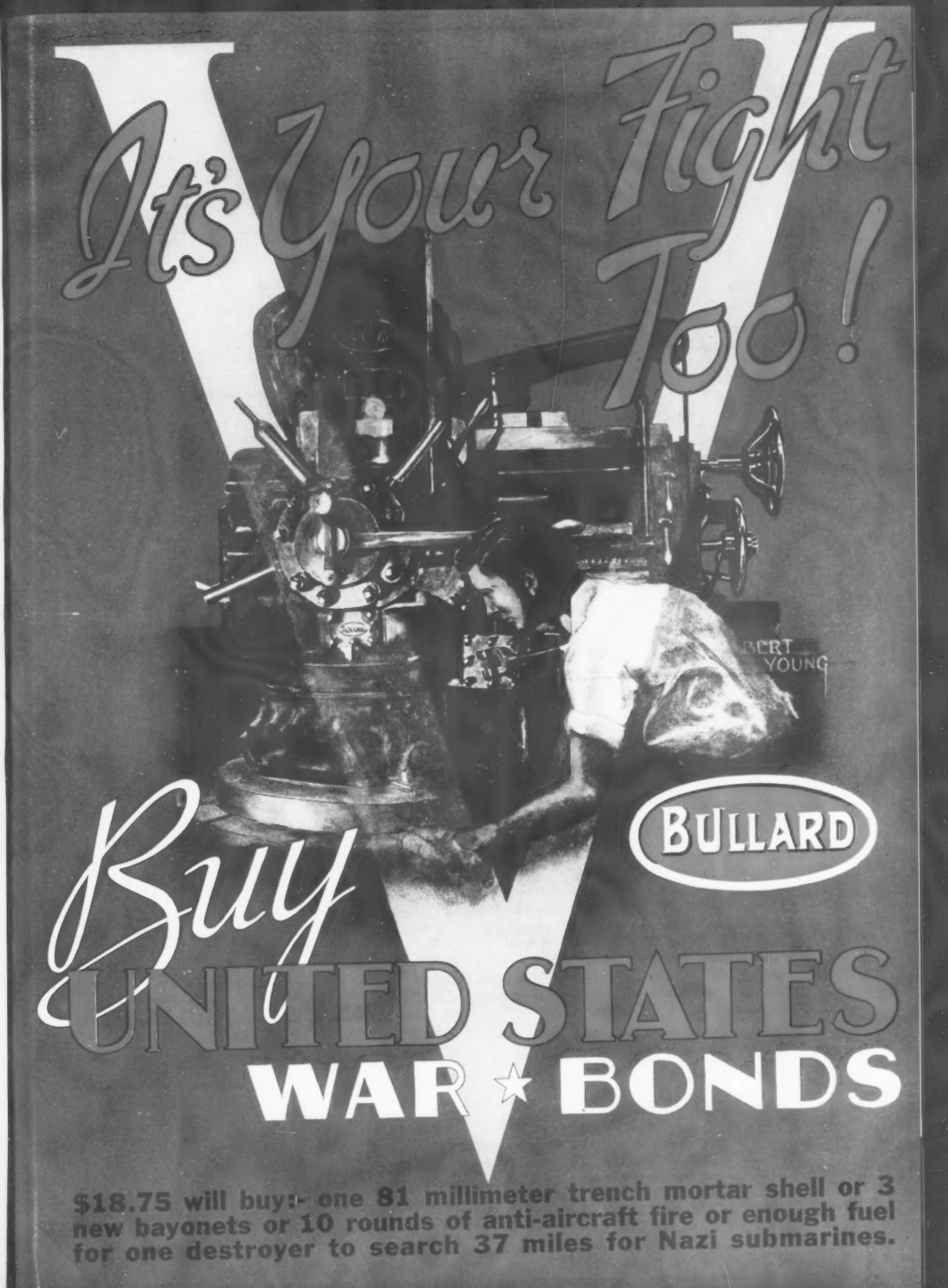
Selective dial feed and rapid power traverse to all heads makes this planer convenient to operate and quickly adjustable.

Anti-friction bearings on all screws and rods, full bearing slide with inverted dovetail, the extended saddle for harp support and a reinforced tool block abutment are small things to look for in buying a planer but the big things you will find in producing at a profit in your shop.

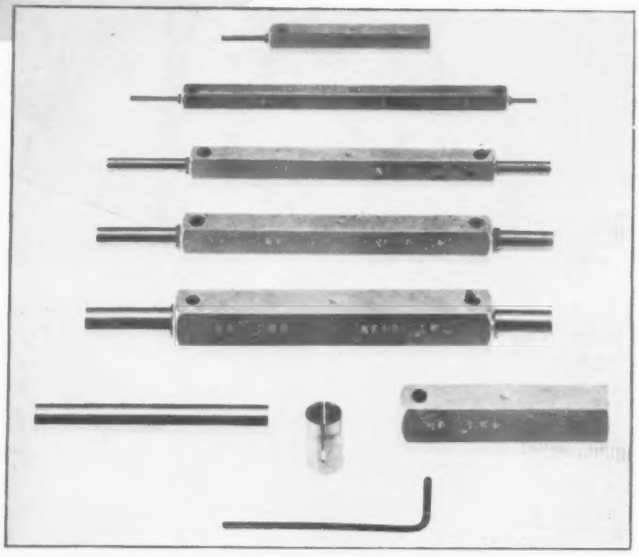
Make your next planer a Cincinnati Hypro. Write for Bulletin 135-AM.



THE CINCINNATI PLANER COMPANY
Planers...Vertical Boring Mills...Planer Type Millers
CINCINNATI . OHIO . U.S.A.


It's Your Fight Too!
BERT YOUNG
BULLARD
Buy
UNITED STATES
WAR ★ BONDS
$18.75 will buy:- one 81 millimeter trench mortar shell or 3 new bayonets or 10 rounds of anti-aircraft fire or enough fuel for one destroyer to search 37 miles for Nazi submarines.

Van Keuren
WIRE TYPE PLUG GAGES



• • • provide an accurate and low cost means of measuring small holes

Van Keuren wire type plug gages are preferred by large manufacturers and government plants throughout the United States for their features of economy, simplicity of design and accuracy. The 2" long gaging units are usable for the entire length, making the cost per unit extremely low as compared with that of taper insert plug gages. Split bushings and headless set screws clamp the wire units securely in the handle. When a unit becomes worn it may be ground off and a new section moved out. Van Keuren standard tolerance: +.00005"—.00000" on Go units, ±.000025" on No Go units—closer or wider tolerances if required.

We recommend wire type plug gages for checking all holes below .190" diameter.

When writing ask for Catalog No. 31.

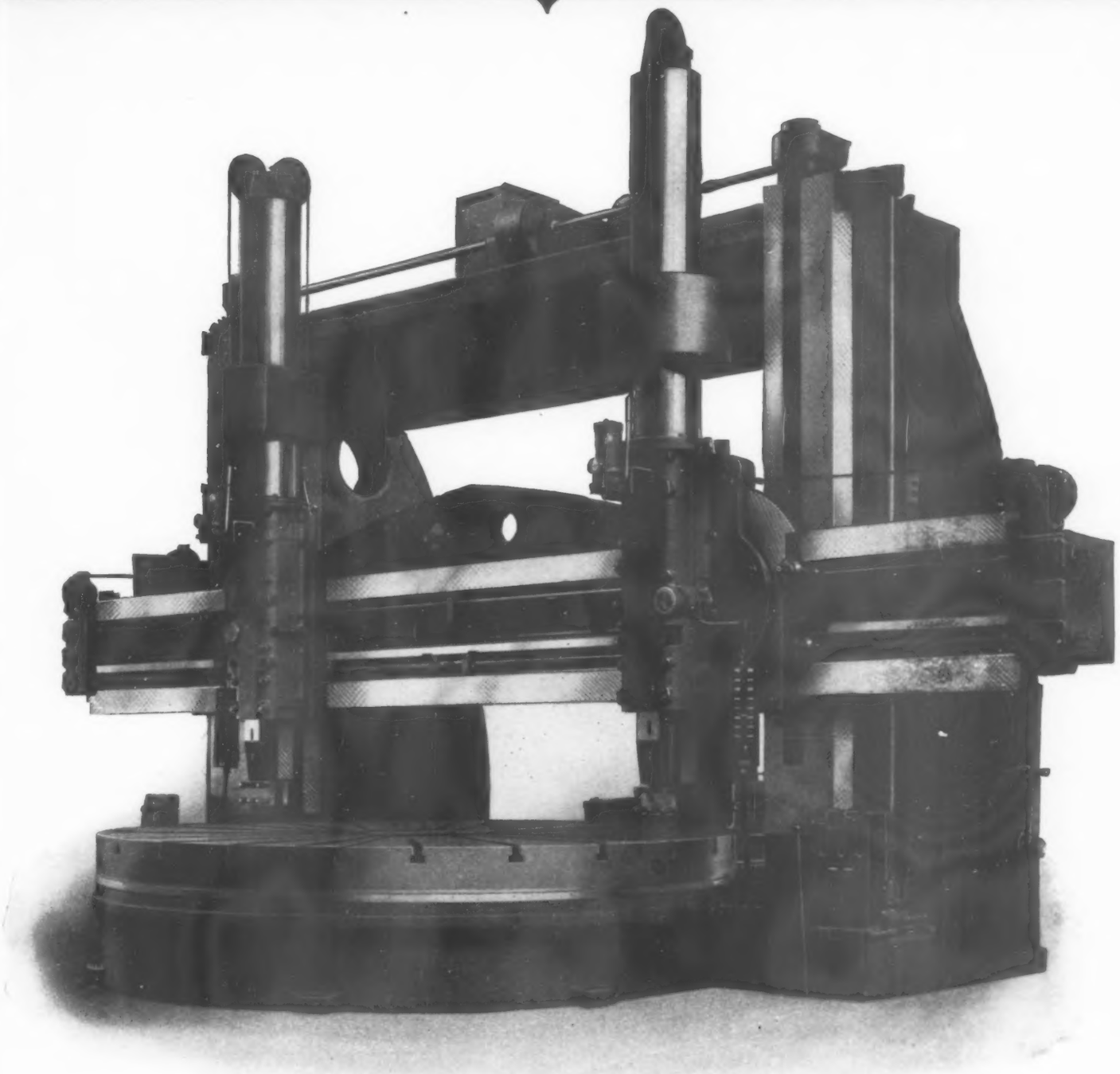
•

WIRE TYPE PLUG GAGE SET No. 60. These gages provide an accurate means of measuring small holes and also standards for checking twist drills in sizes from 1 to 60. (.228" to .040" dia.)

THE Van Keuren COMPANY 176 WALTHAM ST., WATERTOWN, MASS.

Light Wave Equipment Light Wave Micrometers Gage Blocks Taper Insert Plug Gages Wire Type Plug Gages
Measuring Wires Thread Measuring Wires Gear Measuring System Shop Trianales

★ ★ BETTS VERTICAL BORING AND TURNING MILLS ★ ★



We are building at present a number of 14 ft. and 16 ft. Betts Boring Mills similar in all respects to the machine shown above. These are all on Government orders and are allocated for shipment to industrial plants in accordance with the most urgent requirements.

Many new and exclusive features make them outstanding for the tremendous jobs imposed by our War Program. Operation of these Boring Mills has been simplified. Electrical controls are grouped in portable push button stations, one on each side of the machine. These control stations are shown above, suspended from each head. The Machine shown above will swing work 14 ft. in diameter.

BETTS • BETTS-BRIDGEFORD • NEWTON • COLBURN • HILLES & JONES • MODERN

CONSOLIDATED
MACHINE TOOL CORPORATION
ROCHESTER, NEW YORK

Number

22

NOW...A NEW STAR for every Cutter and Tool Grinding Performance

New member of a long line of Covel Grinders, this No. 22 Universal Cutter and Tool Grinder moves into the spotlight for your inspection and approval.

FAST, ACCURATE and FLEXIBLE for TODAY'S TOOLS and TOMORROW'S

So that you may have complete details and pictorial description of this greatest of Covel Cutter and Tool Grinders, an attractive booklet portraying the advantages of this truly universal machine is now ready for release. And when you see for yourself the scores of No. 22 advantages and advancements, you'll agree that here is the Cutter and Tool Grinder of tomorrow—ready TODAY.

★ ★ ★

Write, wire or phone Now for your copy of Bulletin A-112-2 and name of dealer nearest you.

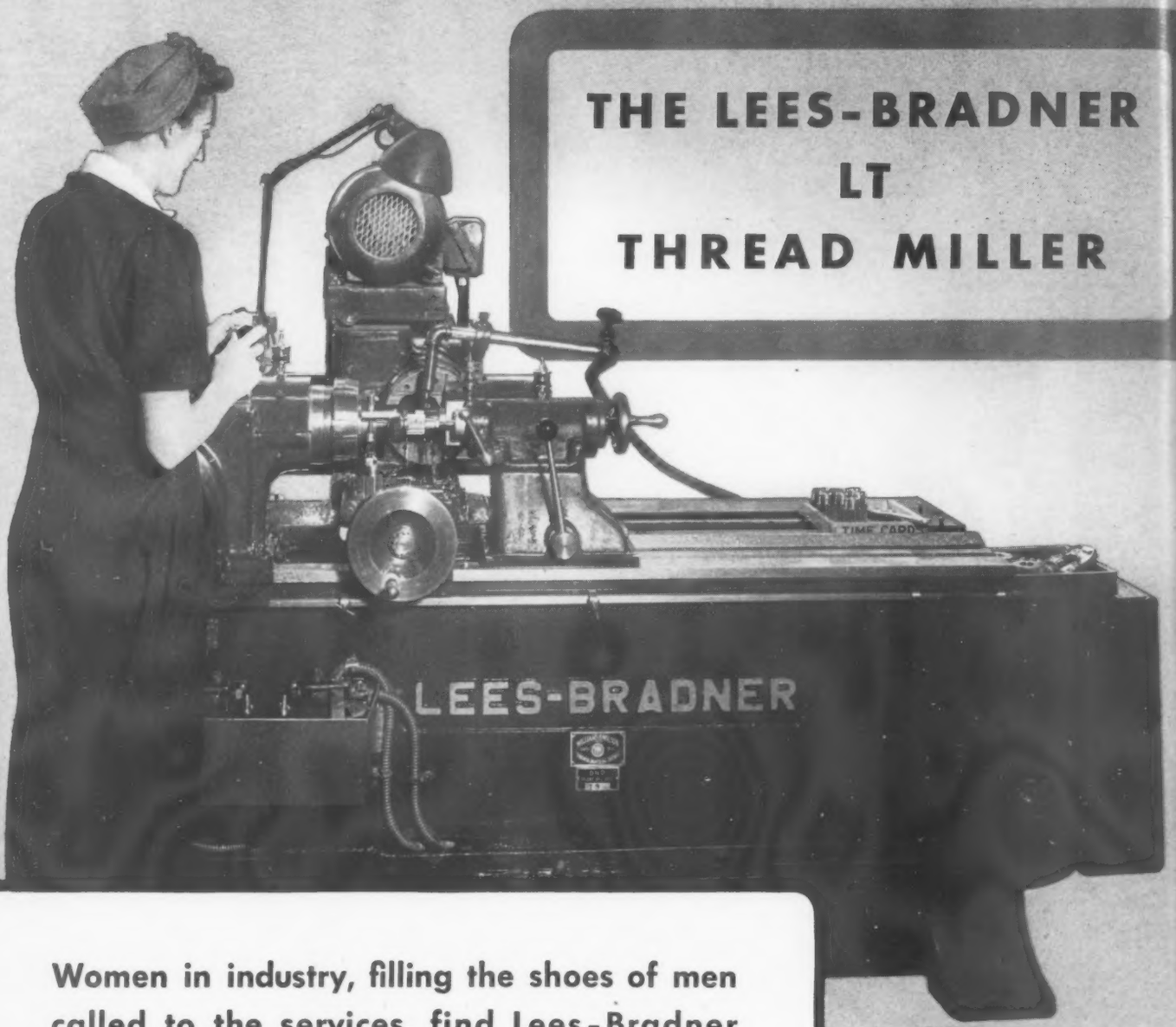
Early deliveries to Essential War Industries.

Grinding Machinery Since 1874

COVEL INDUSTRIAL GRINDERS

COVEL MFG. CO., BENTON HARBOR, MICH.

FOR EASE OF OPERATION



Women in industry, filling the shoes of men called to the services, find Lees-Bradner equipment easy to operate when accuracy and high production are essential. • Investigate the production possible with a Lees-Bradner LT Thread Miller. Ask our engineers for specific data on your threading requirements.

The LEES-BRADNER Company

CLEVELAND, OHIO, U.S.A.

UNION
TOOLS FOR THE "HOLE" JOB!

For large, deep hole drilling to small, delicate precision work you can standardize on Union Twist Drills for every "hole" job and, in addition to drills, the Union line of milling cutters, gear cutters, hobs, saws, reamers, end mills, taps and dies enables you to obtain Union **uniform precision performance** on practically every machining operation in the plant.

Union Butterfield Card

Divisions of the
UNION TWIST DRILL CO.

UNION TWIST DRILL CO.
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Butterfield

THE "ONE BEST" FOR EVERY JOB

Today's problem is to combine maximum efficiency and unquestioned accuracy in the production of parts for ships, guns, tanks, shells and planes. In plants where war production records are being set, Butterfield Reamers are turning out work that meets rigid standards of precision and, at the same time, demonstrating their ability to give long, economical service. The completeness and the uniformity of the Butterfield line make it possible to choose the "one best" tool for every job from this single, convenient source of supply.

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UNION TWIST DRILL CO.

Union Butt e

BUTTERFIELD DIVISION S

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New
Chica
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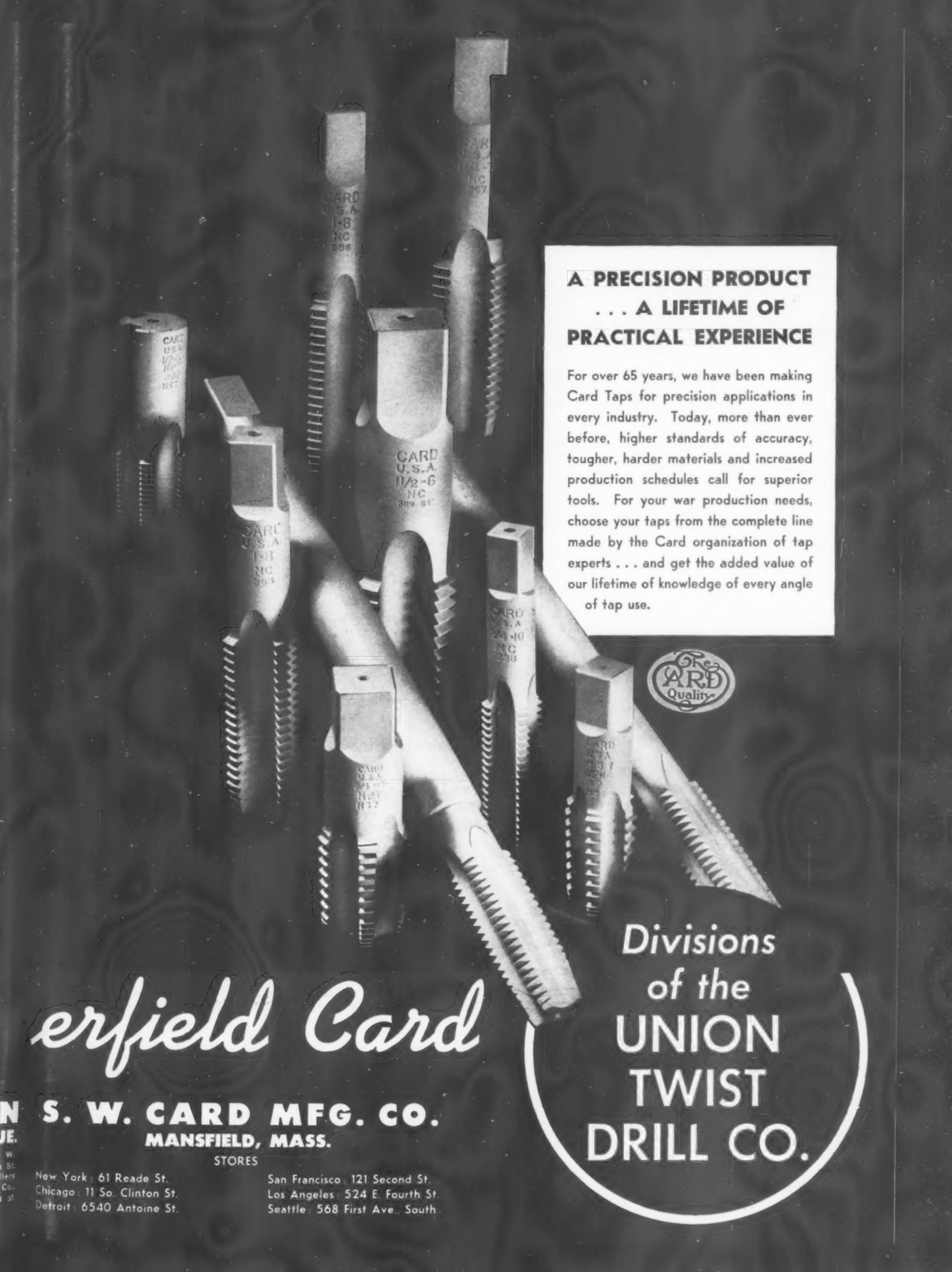

A PRECISION PRODUCT . . . A LIFETIME OF PRACTICAL EXPERIENCE

For over 65 years, we have been making Card Taps for precision applications in every industry. Today, more than ever before, higher standards of accuracy, tougher, harder materials and increased production schedules call for superior tools. For your war production needs, choose your taps from the complete line made by the Card organization of tap experts . . . and get the added value of our lifetime of knowledge of every angle of tap use.

CARD Quality

erfield Card

Divisions of the UNION TWIST DRILL CO.

N S. W. CARD MFG. CO.
MANSFIELD, MASS.

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San Francisco : 121 Second St.
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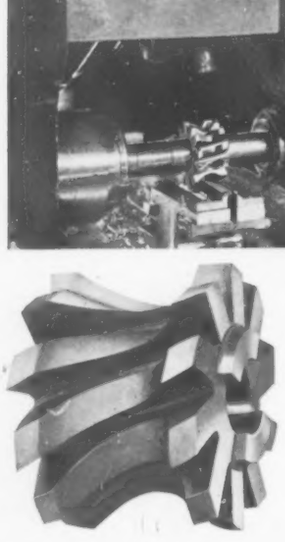
Seattle : 568 First Ave., South

BARBER-COLMAN CUTTERS

FORMED THE BLADES OF THIS TURBINE

Building a steam turbine is exacting work. One of the most important details is the cross-section profiles of the blades and spacers. These pictures, made at Allis-Chalmers Company, show (above) the nearly-completed rotor assembly and (left) one of the stainless steel blades being milled with a Barber-Colman UNGROUND Formed Milling Cutter. Turbines are vital to the war effort — by helping to maintain accuracy and production in this exacting work, B-C Cutters are doing their part toward ultimate Victory.



TYPE OF FORM-RELIEVED MILLING CUTTER USED

This picture shows type of cutter being used in the blade milling operation above. Cutter has spiral flutes with eccentric relief on the teeth, maintaining the original form throughout its life. Used on Stainless steel, the feed is 1.040" per minute with a cutter speed of 35 r.p.m., producing, in two cuts, one piece every 15 minutes. *Accuracy of form is held within .002" total error—with an UNGROUND Cutter.*

BARBER B-C COLMAN PRODUCTS

MILLING CUTTERS, HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, SPECIAL TOOLS

BARBER-COLMAN COMPANY

General Offices and Plant 201 Loomis Street, Rockford, Illinois, U. S. A.

ACCURACY AT THE GUN BEGINS WITH ACCURACY AT THE MACHINE

Practically every weapon of war is an assembly of hundreds of accurately machined parts. The precision and skill of the man and machine producing them are reflected in the accuracy, effectiveness and dependability of the finished product.

In scores of plants where war production is carried on at a record breaking pace, Milwaukees are assigned the job of precision milling—in the tool room or on the production line.

The performance-accuracy of Milwaukee milling machines is the end-product of many features of design and construction. For example single lever, easy-to-see speed and feed dials give the Milwaukee operator complete command of his machine—enable him to control its performance to the fine degree he demands for the expression of his skill.

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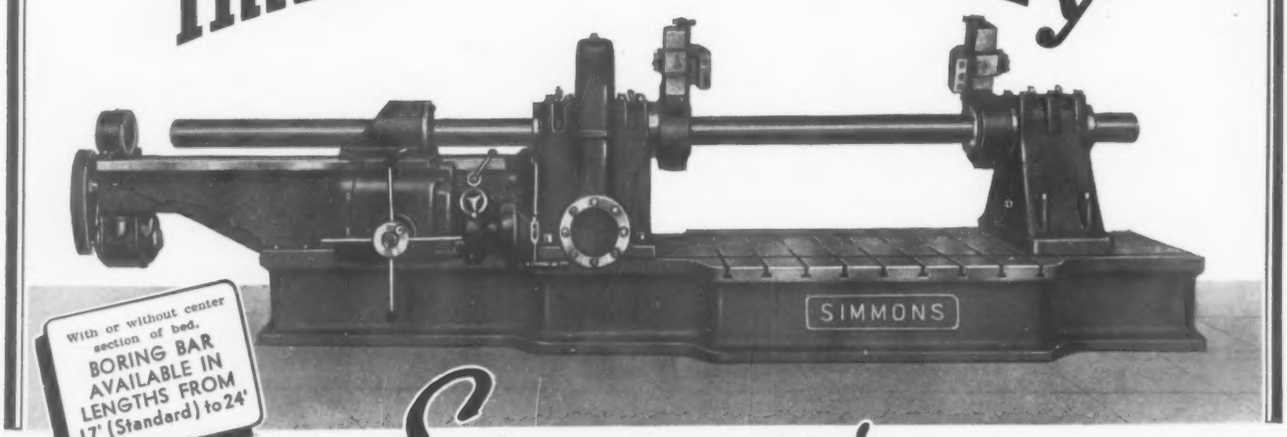

With or without center section of bed.
BORING BAR AVAILABLE IN LENGTHS FROM 17' (Standard) to 24'

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with Micro-Feed Unit

READILY adaptable to many current production problems, this 6" Bar Horizontal Cylinder Boring and Facing machine *is available for immediate delivery*. Inspection is invited, and we will be glad to discuss its application to your work.

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By means of Simmons Micro-Feed Unit, an infinitely variable transmission, this boring machine offers both fine and coarse feeds ranging from .004" to 1.000" per revolution of spindle. Main drive to the boring bar is obtained through a motor driven, six-speed gear box. Gears are of high-carbon steel, and mounted on spline shafts with anti-friction bearings running in oil. Power Rapid Traverse is supplied to the bar in both directions.

Also available without center section of bed. Write TODAY for descriptive bulletin.

SPECIFICATIONS

Diameter, Boring Bar	6"
Travel of bar in one setting	60"
Capacity of facing heads	9" to 38½"
Widened portion of bed	51½" X 68", 18" high

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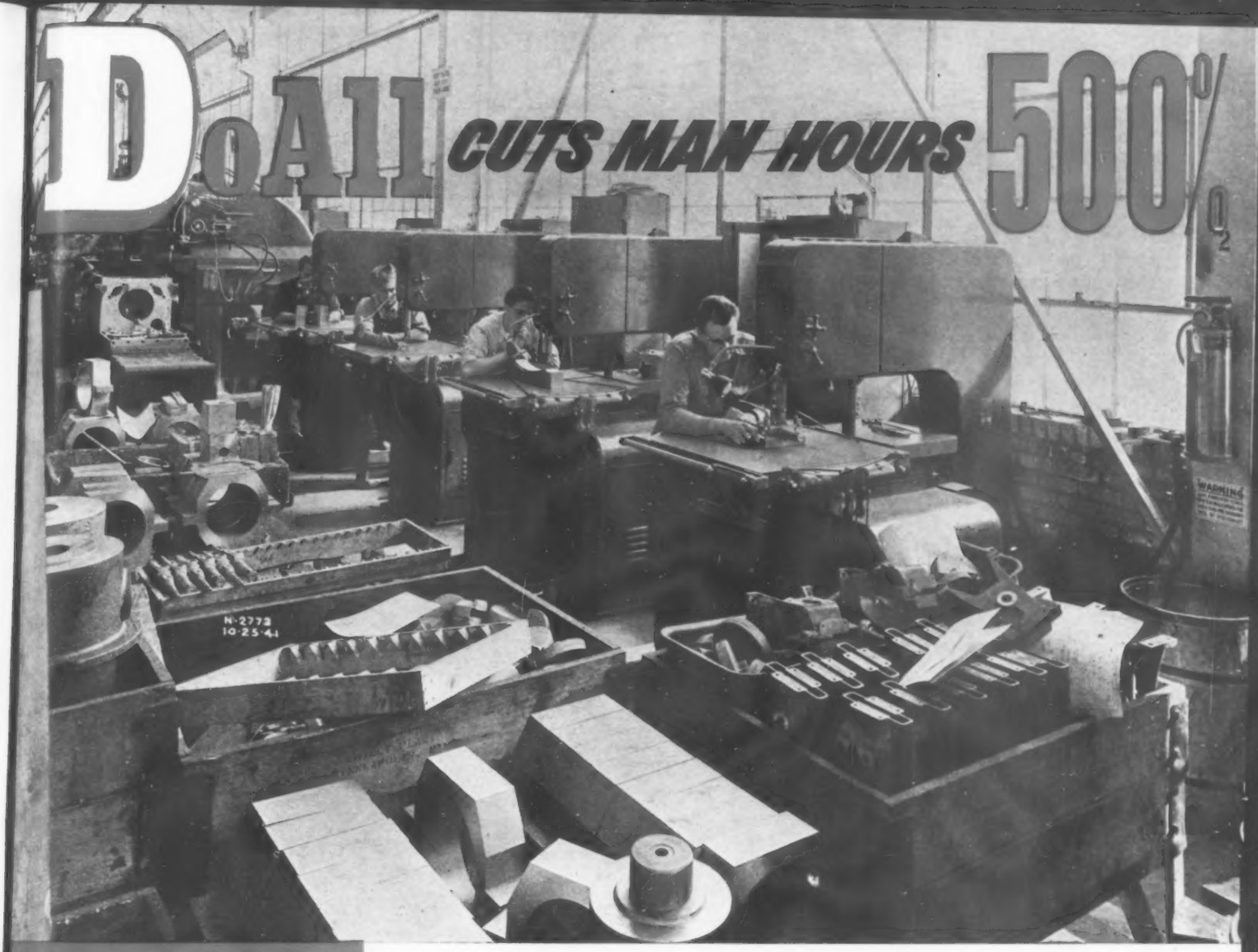

At the first DoAll, drive shafts for wobble pumps are filed in 30 min. each. Formerly they required 3 hours of hand filing. The other DoAlls are sawing out patterns, filing key ways for gun mounts and machining 6" thick die blocks. Bins are filled with DoAll production jobs.

Don't worry about your shape cutting jobs. The DoAll gives you a precision finish on ½" thick armor plate as shown at the left—metal blocks a foot thick —tubing or flats or sheet metal—special replacement parts for machines or equipment. DoAll performance will amaze you because (a) the speed with which cutting is done saves valuable man hours, machine time and power, (b) no further machining is required.

The DoAll is a MUST in every tool and die room, also a regular First Aider on production lines—easily moved to any part of a plant to relieve $5,000 to $40,000 machine tools of overload work.

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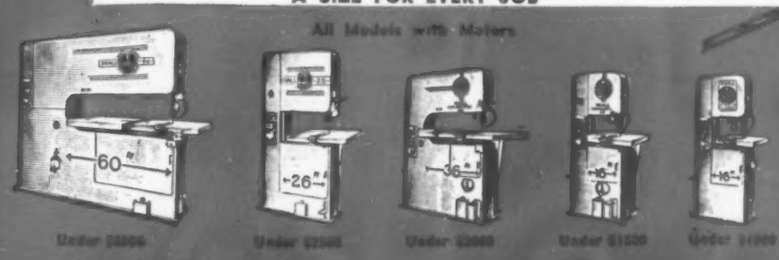

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Two things can lick "too little—too late!" 1. Greater output. 2. Faster production. And both go hand in hand. For if efficiency can be improved and rate of operation increased, the total of perfect parts produced will climb.

This isn't a new problem — not to Union Drawn metallurgists and engineers. Greater efficiency and higher output *plus* finer quality and lower cost per finished steel part have constituted the problem uppermost in their minds and always first on their list of jobs to be done for more than half a century.

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ANSWER No. 1—The uniformly high machinability of Republic Union Cold Drawn Steels which is helping to lick "too little — too late" today. The countless times during the last 50 years when machinability—the all-important factor in the mass production of duplicate steel parts — has been increased. The reduction of tool-wearing abrasives to today's remarkably low point. The smooth, bright machined surface now obtainable. The maintenance of physical properties and heat-treating qualities at high levels. The fastest-machining Bessemer screw steel made today — UNION SUPERCUT.

ANSWER No. 2—The Union Drawn Steel Handbook, now in the hands of thousands of screw machine operators. Part of Union Drawn's job of helping to lick "too little—too late" consists of producing every possible pound of the most machinable steel in needed analyses. The other part — just as important — is that of helping steel parts producers obtain the highest possible rate of production of perfect parts at lowest cost.

The Union Drawn Steel Handbook, first published in 1934, was designed to do just that—to provide automatic screw machine operators with helpful facts and figures obtained from countless tests and unequalled experience in laboratory and shop. The heavy demand for this handbook has necessitated the printing of four new editions — each revised and brought up to date with new information, each substantially enlarged with additional pages of helpful data. The first edition contained 30 pages — the new No. 42 edition contains 84 pages, giving steel analyses and their A.I.S.I. and S.A.E. numbers, physical properties, heat treatment, recommended speeds and feeds for standard tools, spindle speeds, weight and area tables, stock estimating tables and other valuable helps.

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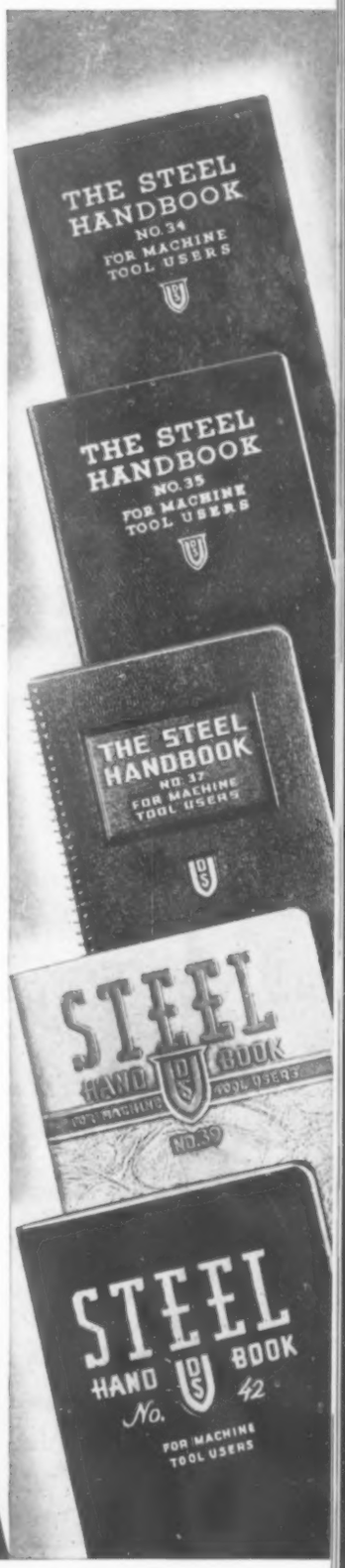

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"Better Grinding" is the first practical down-to-earth book on the art of better grinding. It is not a glorified Landis catalog, nor a dressed up operator's handbook. What it does is explain the basic principles of all precision grinding. And it accomplishes this in a concise, easy-to-read and entertaining fashion.

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New operators are entering industry at a greater rate than ever before. Many of them are women. With relatively few exceptions, they have had little or no previous experience. If they are operating a precision grinder or are being trained for work of this kind, "Better Grinding" is a book the reading of which will certainly add to their understanding and improve their efficiency.

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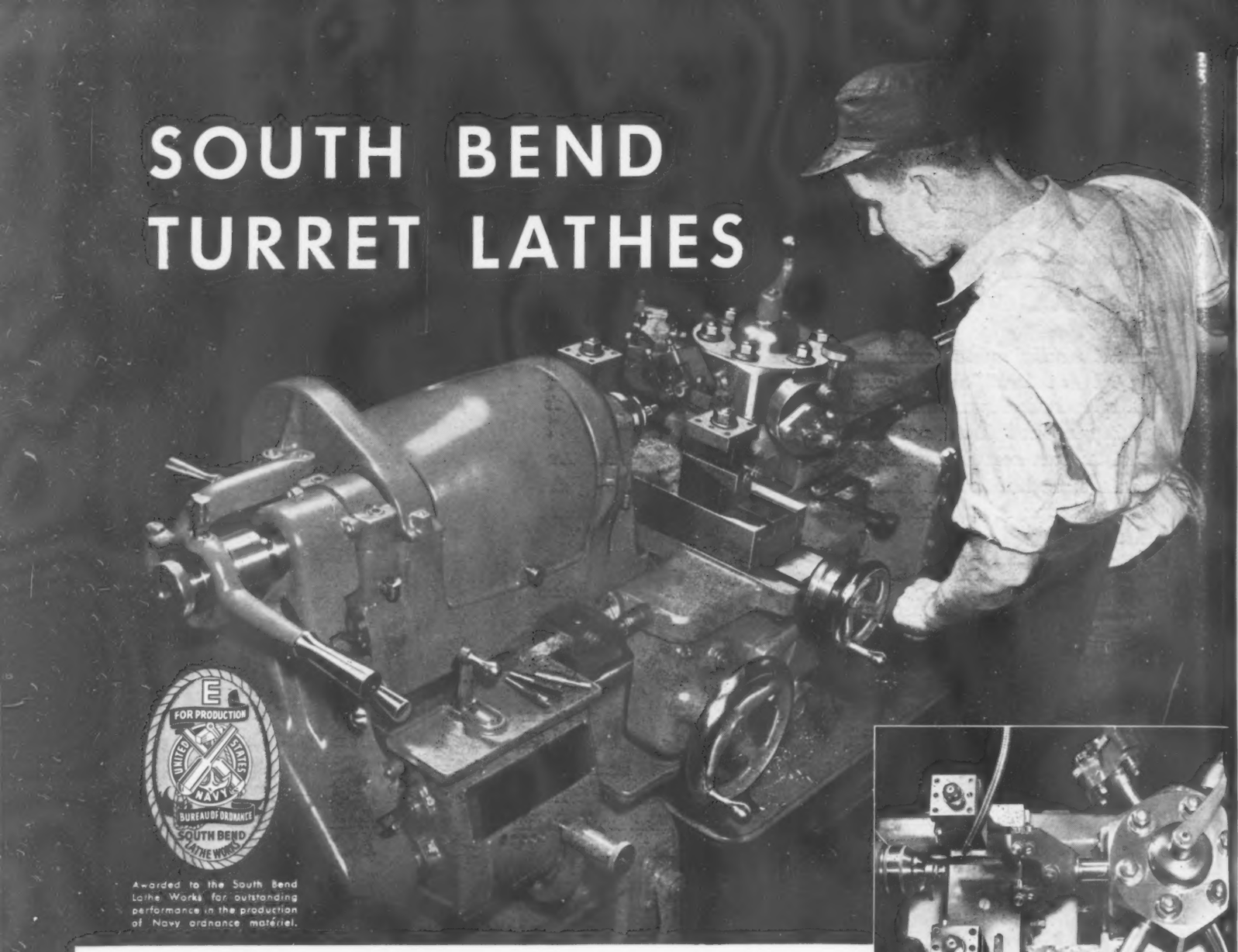
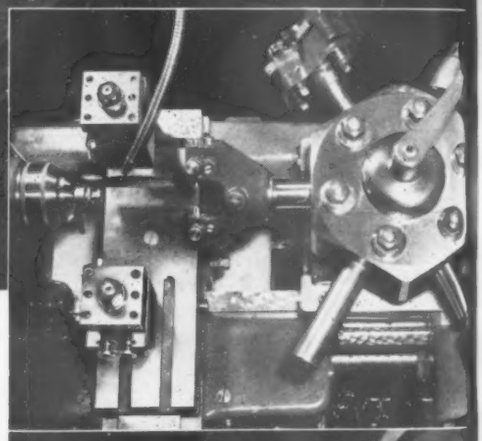
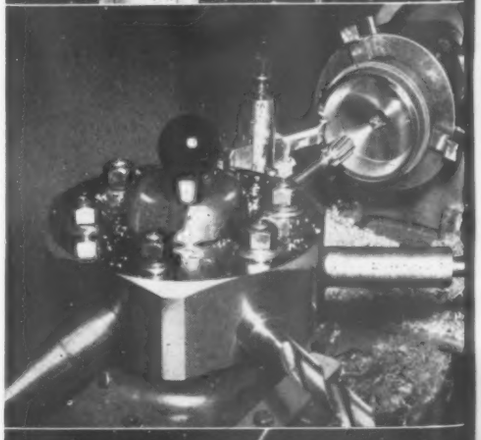
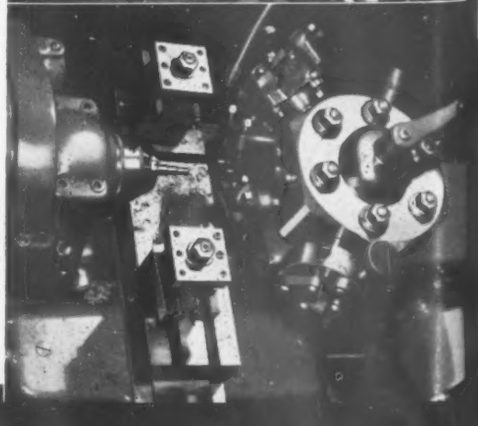


Awarded to the South Bend Lathe Works for outstanding performance in the production of Navy ordnance materiel.







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South Bend Turret Lathes have the kind of versatility that speeds production on many classes of work. A wide range of spindle speeds permits maximum cutting tool efficiency. Rapid change from high speeds to low speeds saves time on thread cutting and reaming operations. A quick change gear box provides 48 changes of power feeds for the universal carriage and the turret. The universal carriage has 48 precision thread cutting feeds driven through a lead screw and half-nuts.

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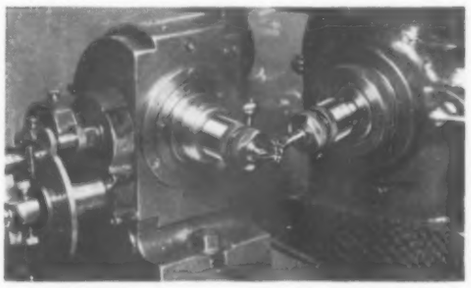
South Bend, Indiana, U. S. A.

NEW....

Thompson SPRING COLLET Adapter

Illustration shows the spring collet adapter as applied to vertical milling machine — takes standard collets —can be used in any machine having a taper spindle.



Double application of spring collet adapter on milling machine — eliminates heavy bulky chucks — free access to work and cutter — note closeness of cutter in proximity to work.

The Thompson Spring Collet Adapter is *new* in design — efficient in action. Consisting of only two parts it fits all standard spring collets — grips tight, no slipping — accurate. Made for all taper spindle machines, it eliminates heavy, bulky chucks — gets closer to work — time saving, economical.

Give your mechanic a better adapter — specify "Thompson".

Write for literature and prices of special adapters.

TRADE MARK Thompson REG. U.S. PAT. OFF.

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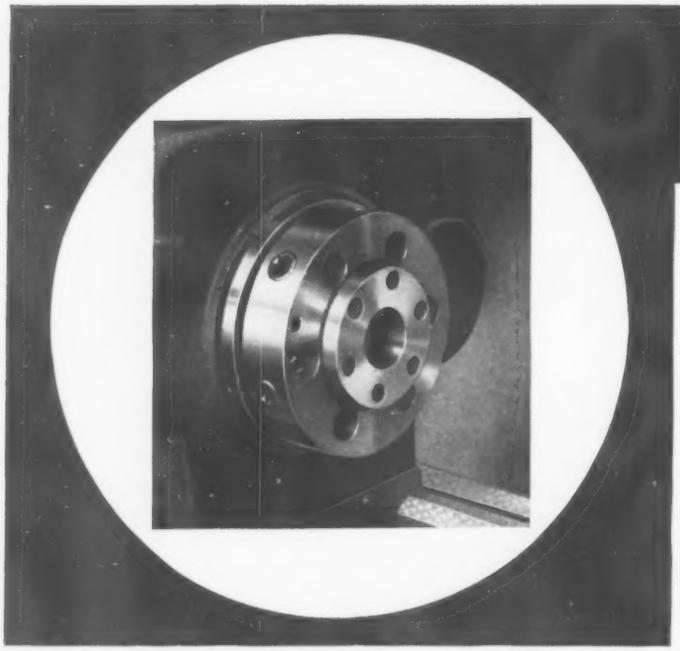

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CAM LOCK SPINDLE NOSE steps up versatility of Sidney Lathes

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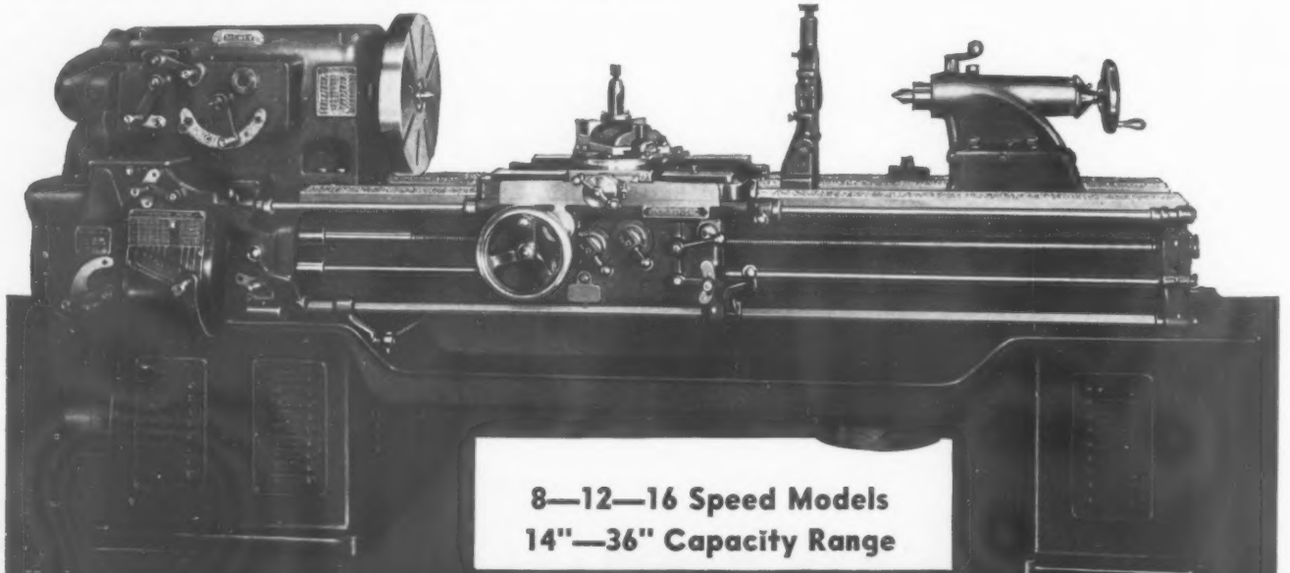
The chuck or face plate is mounted on the tapered portion of the nose and driven by accurately fitted pins equally spaced on face of chuck or face plate. These pins, by their cam-locked action, lock the work holding fixture securely to the spindle.

Also the entire chuck or face plate with work may be removed and further operations completed on another machine, maintaining perfect alignment and accuracy, due to interchangeable feature of locking pins on spindle nose.

Bulletins covering all models available on request.



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The above statement by the Bell Aircraft Corporation refers to countless advantages derived from the Super Service Radial. In this important Defense Plant the Radial illustrated is used primarily for jobs on tools and fixtures where accuracy, speed and ease of handling are advantages of extreme value. Applied to many such operations—and more generally to quantity production—the numerous Cincinnati Bickford Super Service Radials in service today are proving their value as one of America's leading Tools for Defense. Bulletin R-21A lists all features and gives complete details.

ARMY E NAVY
AWARDED SEPT 10, 1942

AWARDED TO
THE CINCINNATI BICKFORD TOOL CO.
SEPTEMBER 10, 1942

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Ideas for VICTORY

from the Production Lines behind the Firing Lines

A CITATION FOR MEN IN WAR INDUSTRY

An Apprentice Found a Way to Add 3½ Hours of Tool Life to Each Resharpening

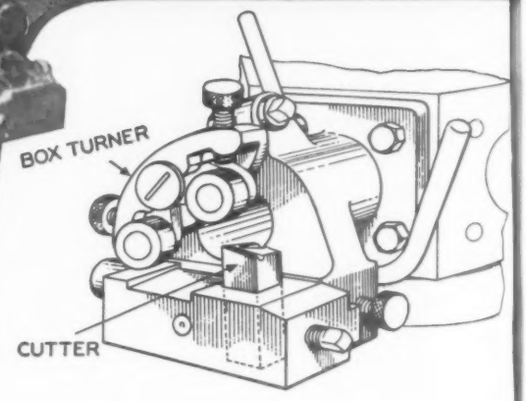
In response to our invitation in Blue Chips, a bulletin issued expressly for shop men, hundreds of turret lathe operators are telling us how they have been able to make better use of their machines and tools to speed their effort in war production.

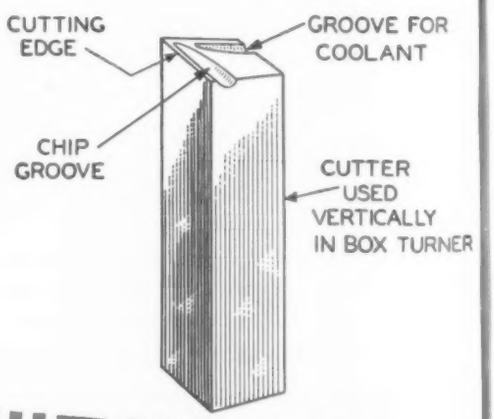
It is not for the ideas in themselves but more for the initiative and enterprise which these operators have shown that we are glad to acknowledge their cooperation with a gold "Victory Pin."

And to Ralph L. Groen, an apprentice operator at Timken Detroit Axle Co., Detroit, goes an engraved "Victory Pin" for what he did.

On one heavy cut with a box turner, he observed only a minimum of coolant was getting to the top of the tool—the cutter had to be reground frequently. He found that by grinding an extra groove in the top of the cutter (see sketch) he was able to get the coolant to the cutting edge, thereby adding 3½ hours of tool life between regrinds.

Many of the practical suggestions of these operators are passed along in Blue Chips, a shop paper sent free to the homes of turret lathe operators. Your operators will enjoy reading it and will benefit. Make sure your operators are on our list to receive it. Write Warner & Swasey, Cleveland, Ohio.





WARNER & SWASEY FOR VICTORY

YOU CAN TURN IT BETTER, FASTER, FOR LESS ... WITH A WARNER & SWASEY

WHAT'S IN THIS ISSUE

F. D. NEWBERRY

P. N. LOVE

TRAINING IN TIME

Eight months after ground was broken, the Westinghouse plant in Canton was in production on gun mounts. Most of the personnel was drawn from the surrounding area, and four-fifths of the production workers had no previous industrial experience. The training program that made this possible, selecting and training workers while the plant was being built, is really "A Plus Training System." It is described by Frank D. Newberry, vice-president, and P. N. Love, Supervisor of Industrial Relations, Canton Ordnance District, Westinghouse Electric & Manufacturing Company. Page 1349.

RAILROAD METALLIZING

Demands on their power and the scarcity of replacement parts are causing railroads to turn more to the use of sprayed metal to build up worn surfaces. The application of metallizing to a number of parts is described in an article on this subject. Page 1354.

MODERN ALADDIN

There is nothing boring about the way an old engine lathe and a planer were combined in an emergency to produce a horizontal boring machine. William Dzus, president, Dzus Fastener Company, tell how. Page 1363.

REMARKABLE REPAIR

When the only internal-spline gear shaper cutter on hand in one plant was broken, production faced an indefinite shut-down. The tool was reclaimed, however, by designing a stronger cutter body, and silver-soldering the old tool tip to it. Page 1357.

SHELL FORGINGS

The pierce-and-draw method, and the upsetter method of forging high-explosive shell account for about 95 percent of the production. J. B. Nealey, Office of the Chief of Ordnance, discusses these and other methods in an Armament Section article "Notes on Shell Forging." Page 1383.

DIE MAINTENANCE

In his third article on the maintenance of press tools, H. R. Hageman discusses methods of reducing die maintenance costs. The proper application of springs is also considered. Page 1358.

MORE ON PLASTICS

Milling and sawing methods, and press operations, are discussed by John Sasso in a second article on working with plastics. Finishing methods are also covered. Page 1360.

TOOL RACKS

Special racks keep all of the tools in position where they can be secured easily, when a number of tools are required for a single operation at the Landis Tool Company. One such rack and other practical "Shop Shots" are included in a spread of pictures. Page 1352.

ANOTHER WINNER

The time required for milling a sharp end on a center bearing shaft support for an aircraft engine was reduced from 40 min. per piece to 6 min. per piece by first drilling pilot holes. The additional drilling time was only about 2 min. This time-saving idea was contributed by an employee of the Wright Aeronautical Corporation, and is one of a number of such "War-Winning Suggestions" described in this issue. Page 1364.

WEAR ALLOWANCES

A Reference Book Sheet on "Wear Allowances and Gage Maker's Tolerances" by A. Sprung, Production Service Department, War Production Board, shows the practice in the plants of a U. S. Ordnance District on ordnance production. Page 1389.

JOSEPH L. AUER

RECOIL MECHANISMS

Welding plays an important part in the production of cradles for the various sizes of recoil mechanism—so large a part that more than 2,500 in. of arc welding is used in one of these cradles. In the Armament Section, Joseph L. Auer, vice president and general manager, R. Hoe & Company, tells how the recoil mechanisms for anti-aircraft guns are made. Page 1371.

COMING

A recently developed procedure for quality control makes it possible to determine when the variation in quality is increasing early enough to correct the trouble before it begins to cause rejections. The first of two articles describing this method of control will appear in an early issue.

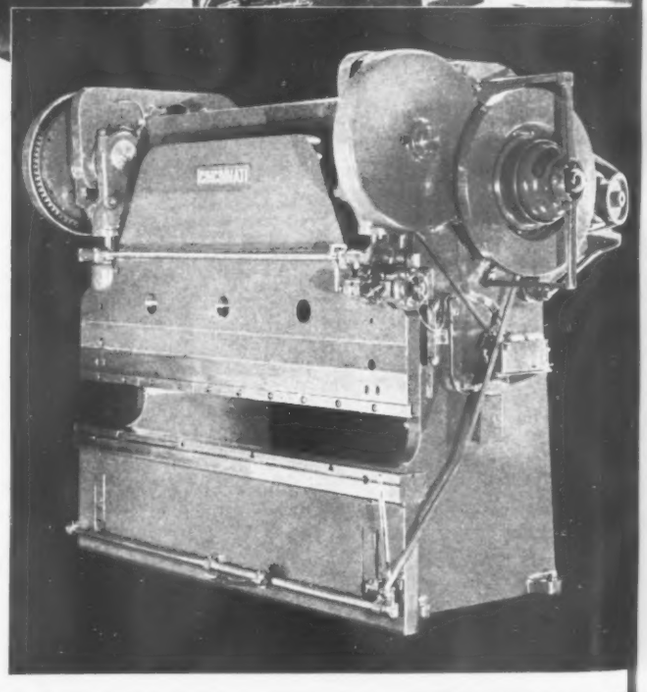
When Henry Ford undertook the production of bombers at Willow Run, he completely revamped tooling procedure. An Armament Section will discuss the dies and fixtures for this plant. Look for it soon.

Performance on the production line must precede performance on the battle line.

"Round-the-clock", Cincinnati Press Brakes are speeding the production of airplanes, tanks, ships, and equipment for our armed forces.

A Cincinnati Press Brake may "step-up" your production.

Write for recommendations and Catalog B-1.



THE CINCINNATI SHAPER CO.

CINCINNATI OHIO U.S.A.

SHAPERS BRAKES SHEARS

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor

A Plus Training System

BY F. D. NEWBURY and P. N. LOVE, WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY

The basis of this program is intense training on simplified operations for workers without previous industrial experience

PRODUCTION of gun mounts and ordnance equipment began just eight months after ground was broken for a new plant which Westinghouse had contracted to operate for the United States Navy at Canton, Ohio. The operation of the plant presented an unusually difficult problem because the critical shortage of experienced workers made it necessary to train within ten months operators capable of maintaining the extreme accuracy demanded in machining ordnance items. Today, with the plant drawing close to full operation, nearly 80 percent of the production workers on the plant roll are men graduated from special training courses. Practically all of the additional men and women required will have to be trained to reach the anticipated peak employment.

While the plant was being built, it was realized that the labor problem could be solved only by breaking down the machine operations as finely as possible to minimize the skill required, and then train personnel to do these simplified operations. Hence, the following long-range training program was established:

1. The employment and training of foremen, group leaders, inspectors, production clerks, accounting clerks and layout engineers.
2. The employment of 72 experi-

Mechanical aptitude and arithmetic tests are used to select trainees. A prospective employee's background is studied to determine whether or not he can adjust his scale of living to wages paid a trainee. Only 30 percent are selected for training

Instructors in the plant help trainees make machine set-ups, grind tools, interpret drawings and to lay out ordnance parts. The results of continued home study are reflected in grades used to determine their advancement

enced mechanics and machine tool operators for advance training in ordnance work at the naval gun factory, Washington, D. C., prior to opening the Canton plant.

3. The establishment of schools prior to the opening of the plant in which to train inexperienced personnel on machine tool operations that had been broken down and tooled up as much as possible.

4. Further training in the ordnance plant of graduate trainees, until they become skilled specialized machine operators.

This program has provided an operating force far larger than could have been built up by depending on the rapidly diminishing and now practically non-existing supply of skilled help from the usual sources.

Men Trained in Leased Shops

Almost six months before the Ordnance plant was opened, training schools were established by leasing two machine shops in nearby localities. One shop was rented for 16 hours a day, and operated during the second and third shifts, six days a week; the plant was used by the owner during the first shift for manufacturing his own products. The other shop was leased outright and training classes were conducted 24 hours a day, six days a week. In addition, trainees on the Westinghouse payroll entered vocational training schools in Canton, where shop facilities were used 48 hours a week.

An attempt was made to utilize WPA and NYA training facilities in Canton and nearby cities. Their machine shop courses were changed from those of a general nature to specialized machine training. The graduates were earmarked for Westinghouse. However, many of them secured positions with other companies before the ordnance plant opened, and trainees secured from this source were one-fifth of those originally estimated. As a result of this experience, it was determined to utilize to the fullest possible extent the training courses established by the company itself.

Trainees were and still are selected for mechanical ability, with consideration being given to other factors which might influence them to leave their jobs after employment. Suitability for employment is established by the Minnesota mechanical aptitude test and the Otis arithmetic test. Anyone making a low grade on these tests is considered not qualified for machine training and is automatically eliminated. Prospective employees are asked questions relative to their scale of living and ability to adjust it to the salary paid while in training. Over 5,000 applicants have been examined to date, 30 percent of whom were selected for training.

Selected employees are given approximately twelve weeks training in the school. There is one instructor for every 15 to 25 trainees, and all work 48 hours a week. Each student receives training on a specific machine operation; also, he is given instruction in blueprint reading and the use of precision measuring instruments. Over 90 percent of the work done in these schools is produced for the ordnance plant and must pass rigid inspection. The remaining work is done on scrap materials secured from forge shops and foundries supplying the ordnance plant.

Training Continued in Plant

Upon completion of school work, trainees are transferred to the ordnance plant, where the first six months of their employment is considered as additional training. The wage scale for these men is set in three brackets, one for each two months of the additional training period. At the end of each bracket, the foremen, time-study men, and training supervisor make up separate rating reports on each trainee from which a final average grade is worked out. Grades are dependent upon attendance, appearance, sincerity, initiative, self-reliance, safety, dependability, attentiveness, ambition and performance. Trainees not receiving passing grades may be kept in each bracket longer than two months.

Elimination of employees is not a

There is one instructor for every 15 to 25 trainees in the training school. These instructors are experienced machinists. Classroom work is continued until the end of the six months additional plant training

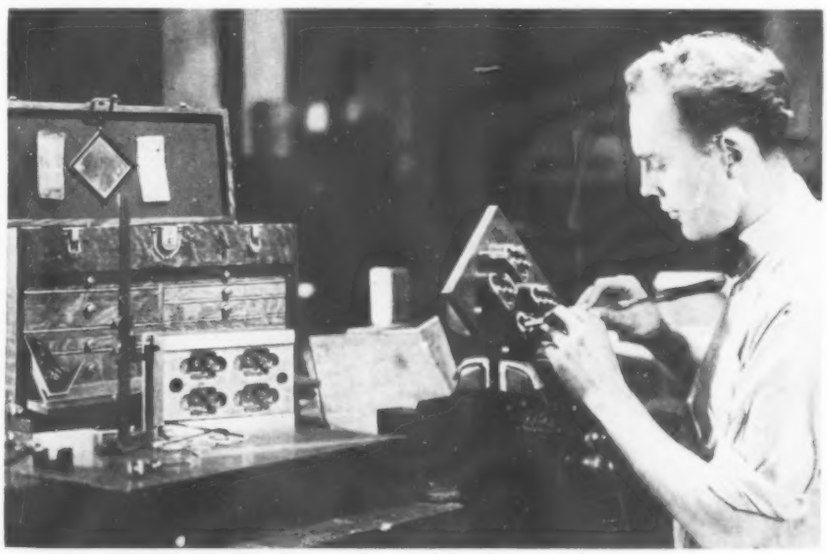
function of the grading system, rather it is an intense effort to retain every man on the payroll in a position where it is finally decided his efforts are productive of the most efficient results. If there is any indication that a trainee is not efficient on the job to which he has been assigned, the grading system helps to place him where his particular talents can be utilized and developed. This is emphasized by the fact that over 93 percent of the trainees transferred to the plant up to September 1, 1942, are still working as machine operators.

Along with machine training in the ordnance plant, classroom instruction and homework are given. Classroom instruction consists of demonstrating machine operations, care of machine tools, care and use of precision instruments and gages, safety, tool grinding, and blueprint reading. Homework involves studying textbooks on machining and blueprint reading.

From three to fifteen trainees are placed under one instructor or group leader in the plant, the exact number depending on the work and type of machine tool. The group leader or instructor helps trainees to lay out parts, make tool set-ups, use measuring instruments and gages, grind tools and interpret drawings. Most of these instructors and group leaders are the men originally trained in ordnance work at the naval gun factory in Washington.

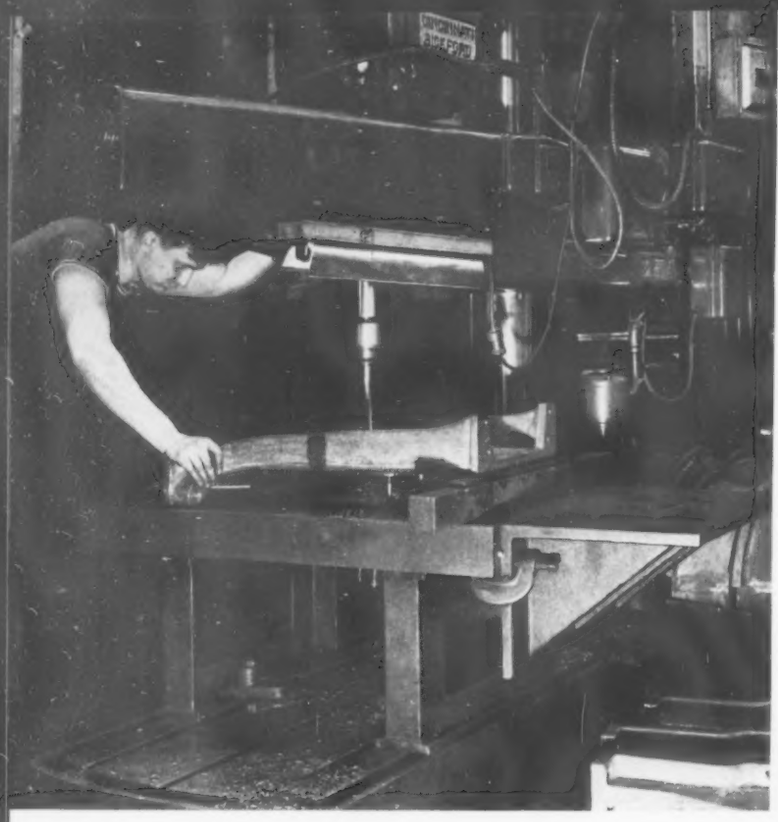
Regardless of the fact that the majority of machine operators prior to employment had little or no industrial experience, careful selection and intensive training has resulted in a remarkably low labor turnover and an exceptionally low percentage of defective work. The detailed tooling of each machine and for each operation performed, together with the modern machines used, transfers the skill of a first-class machinist to the machine, its attachments, jigs and fixtures. These are the reasons why relatively inexperienced operators can be employed.

Much of the success of the training is traceable to the personal leadership of O. J. Manse, Training Supervisor who was in direct charge of the effective execution of the operator-training program.



Selected trainees receive twelve weeks instruction in nearby machine shops. They seldom receive training on more than one type of machine tool, which is continued for six months after they enter the ordnance plant

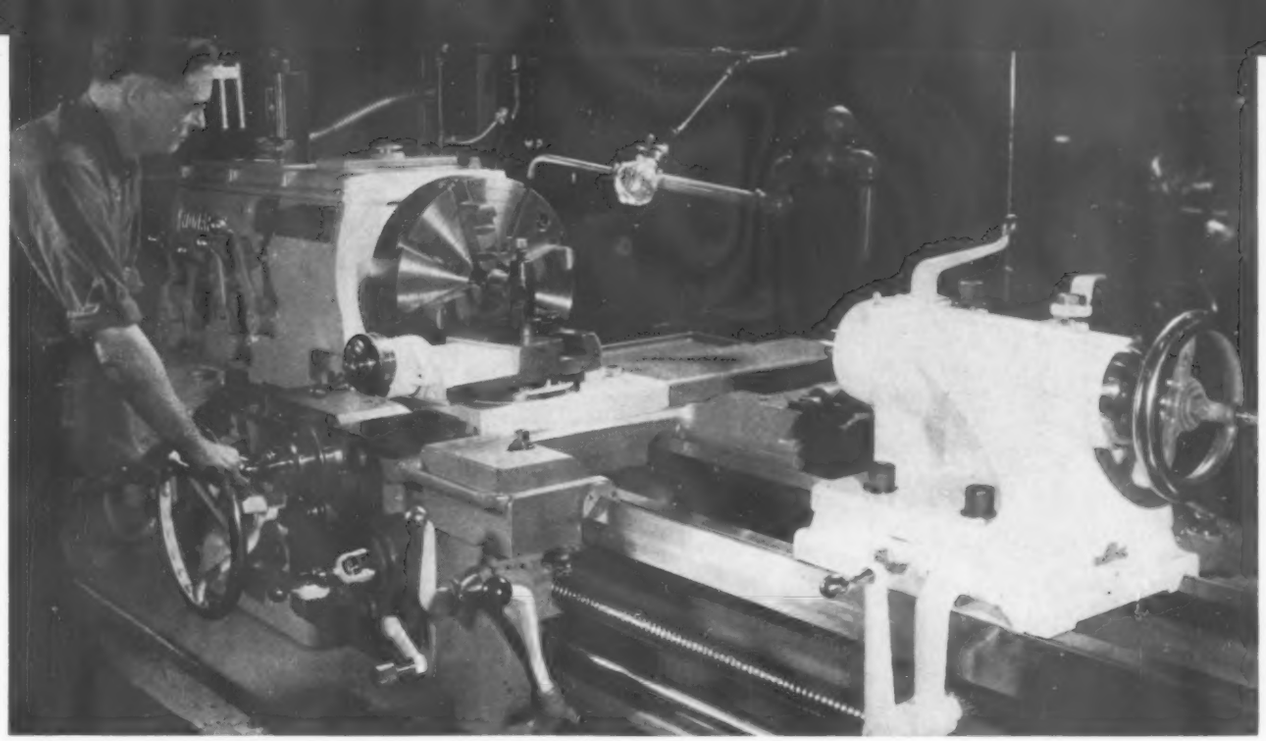
Shop Shots



An improved skid rack developed in one of our Works enables the truck operator to obtain any skid or pallet desired at any time. It has been found that the flexibility of this arrangement is of considerable advantage where the quantities of material to be stored are not large enough to warrant the stacking of pallets. This has proved to be an economical method of obtaining additional floor space and of using the available headroom. The racks are designed for 25-ft. square bays, and leave a 6 ft. aisle between double sections of the racks. Racks are 43-in. square. Wheeled trucks can be stacked in the racks as shown, as well as standard skids or pallets. One and one-half times the number of skids or pallets may be placed in the racks than can be placed side by side upon the floor leaving no aisles of any kind. L. W. Bailey, Methods Department, General Electric Company.

Supplementary lighting for each radial drill press in the plant has been provided by mounting a standard fluorescent lighting unit with a special tinplate reflector on the arm of each machine. Shadowless illumination provided by these units has reduced operator fatigue and results in more accurate drilling of castings and other parts to layout. Package Machinery Company.

Eye protection is afforded every employee in Vega's Burbank plant. The cart shown was installed to promote the wearing of eye protectors and to give better service to employees. Safety Attendant Neil Tierney is shown fitting new safety glasses for Ruth Crump of Vega's Manufacturing Planning department at the specially constructed "Goggle Cart." The new type cap worn by Miss Crump weighs only an ounce, has a blue visor, net sides for ventilation, and a transparent oil-silk top. Vega Aircraft Corporation.



Painting parts of this engine lathe with ivory enamel has resulted in less eye fatigue due to long hours at war work. The light-color of these parts clearly reveals danger points around moving elements; also, it provides an incentive for keeping the machine clean. On the basis of time-study tests made on this lathe, other machine tools in many Westinghouse plants will be similarly painted. Westinghouse Electric & Manufacturing Company.

Simple vise-type clamps, fitted on trunnions to permit tilting, serve as assembly and soldering fixtures in the electrical assembly department. Dorothy Burgess is shown soldering wires assembled in a connection plug to go in a B-17F Flying Fortress. After soldering, the assembly is inspected and covered with flexible conduit for installation in one of the B-17's electrical control units. Vega Aircraft Corporation.

Special racks for making tools easily accessible will help increase production on machine tools that operate a large percentage of available working hours. This is especially true when a number of tools are required for a given operation. The rack shown is mounted on a pedestal so that it can be turned conveniently. Shelves hold wrenches and other tools. Quick-acting chucks are used on all radial drills in this plant so that the spindles need not be stopped in order to change from one tool to the next. Landis Tool Company.

Railroads Extend Use of Metallizing

Sprayed metals help to reduce cost of locomotive, car and shop maintenance. Worn parts, often scrapped, are reclaimed

THE PRESENT heavy demands for motive power, rolling stock and repair facilities, as well as the scarcity of replacement parts and alloy steel bar stock, have added greatly to the maintenance problems of American railroads. As a means to reduce maintenance costs, many railroads have long built up worn surfaces with sprayed metal. This takes on an added aspect today, because experience gained heretofore in the use of metallizing equipment has permitted the railroads to extend its use, thereby placing in service immediately many repaired parts that otherwise would have been scrapped and replaced only after undue delay. The accompanying table shows the extent to which several eastern railroads are using metallizing equipment for repairs to locomotives, cars, and all types of shop equipment.

Pistons and Shafts

The outside diameter of shafts, rods, and pistons are, in the majority of cases, prepared for metallizing by turning with a sharp pointed tool, flattening the ridges thus formed by using a rotary shaft-preparation tool similar to knurling tool, and undercutting the ends of this turned area at 30 to 45 deg. The parts are metallized immediately after preparation to eliminate the accumulation of dust, grease and rust that would obviously prevent a good bond between the parent and sprayed metals. Another method is to grit or shot blast the undercut area, turned smooth with a round-nose tool.

Shafts are metallized by mounting them between centers in a lathe, with a dog on the part driving it from the chuck. The metallizing gun, mounted in the toolpost is fed along the work at the average rate of 0.125 in. per revolution of the part. The peripheral speed of the part being metallized ranges between 25 and 50 ft. per min. In general, light coats of sprayed metal are obtained with high peripheral and carriage speeds, while heavier coats are obtained with lower speeds.

One locomotive shop has found it advisable to install an automatic reversing mechanism on the lathe to prevent built-up metallized areas at the ends of the parts. This device is shown in one of the drawings. Two idler pulleys *A* and *B* running on leadscrew *C*, are engaged to drive the leadscrew when clutch *D* is moved to the right or left. When idler *A* is engaged, the leadscrew turns clockwise, bringing the tool carriage toward the left. As the carriage approaches the end of its travel, set by stop *E*, shaft *F* moves toward the left. A trigger release plate *G* is keyed to the extension of shaft *F*, and is slidable on bracket *H*. Clutch *D* is bolted to clutch bracket *H*. Triggers *I* and *J* are stationary and are pivoted to the housing of the reversing mechanism.

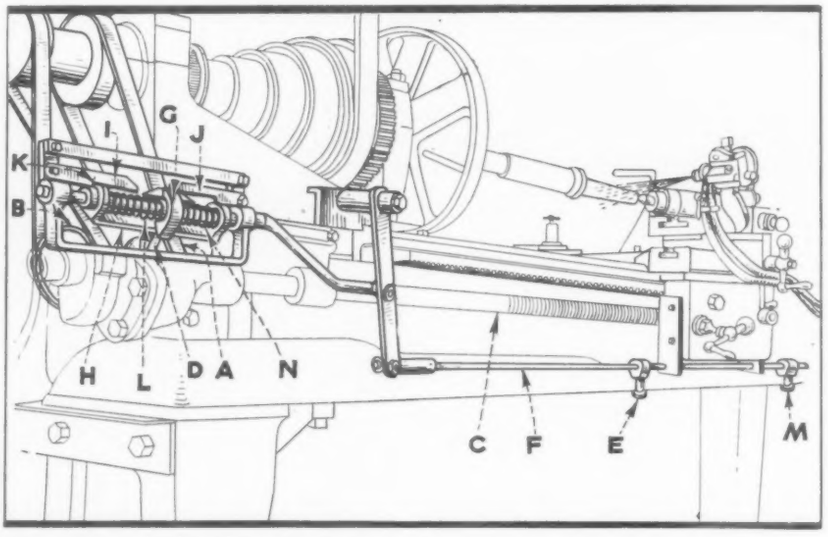
When the lathe carriage moves to the left from its starting position, trigger *I* is engaged at the shoulder of the clutch bracket at *K*. Shortly after the carriage hits stop *E*, trigger *I* starts to mount the bevelled edge of the trigger release plate *G*, during which time spring *L* is compressed. When the trigger *I* has been raised far enough to disengage itself at *K* from clutch bracket *H*, spring *L* is released, thus forcing clutch bracket *H* and the clutch suddenly to the left. This disengages the clutch from idler *A* and immediately engages idler *B*. Since idler *B* is driven from the machine spindler by a crossed belt, the leadscrew immediately starts revolving in a counter-clockwise direction, thereby feeding the carriage to the right.

This procedure is reversed as the tool carriage approaches stop *M*. In this instance, shaft *F* and its extension moves to the right, pulling with it trigger release plate *G* and compressing spring *N*. When trigger *J* has been raised high enough to release clutch bracket *H*, spring *N* is released to force bracket *H* and its clutch suddenly toward the right, thereby engaging pulley *A* and once again reversing the direction of the carriage movement. Obviously, this mechanism reverses the metallizing gun at the end of the lathe-carriage travel and does this instantaneously. With the use of this device, a sprayed surface of uniform thickness is obtained over the entire length of the part, thereby facilitating finish machining and grinding.

Crankshafts Can Be Sprayed

When parts have been metallized, they are finished by grinding and/or machining, with wet grinding being the most preferred practice (*AM*—Vol. 86, page 1087).

A large percentage of locomotive parts metallized is of the foregoing character, that is, shafts, rods and pis-



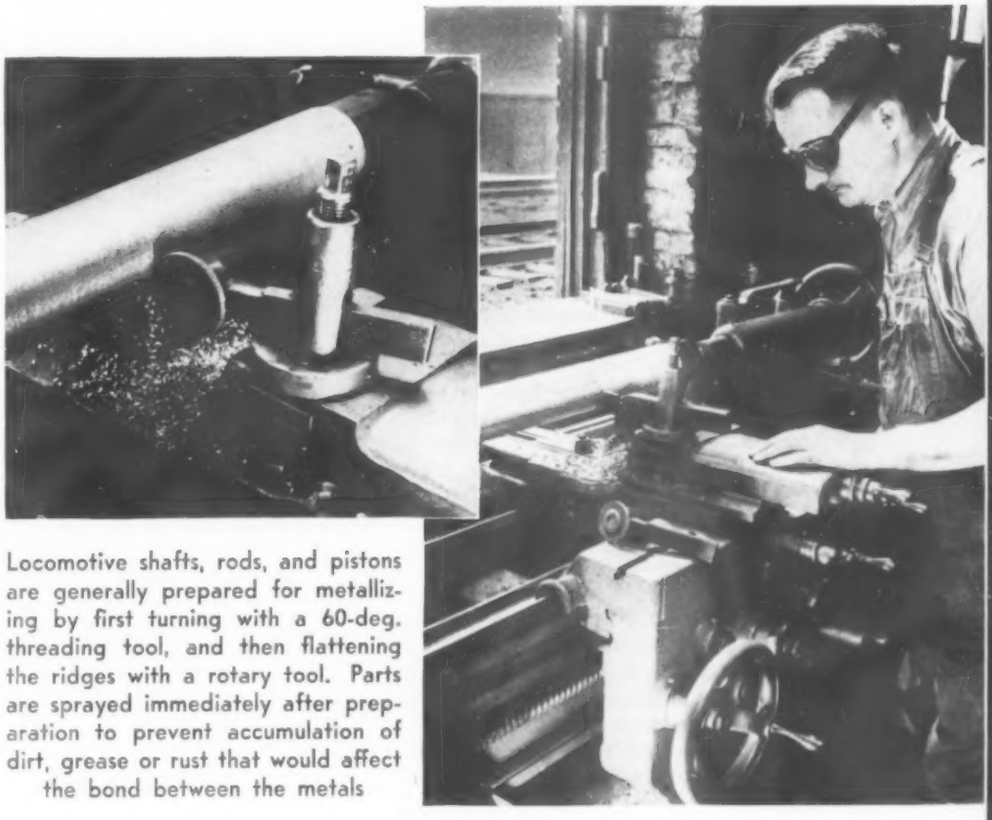
This device is used to reverse the lathe carriage automatically when the metallizing gun reaches the end of its travel. It prevents built-up metallized areas at the ends of the work, thereby facilitating the finish machining and/or grinding of the metallized surface

Three areas on this feedwater-pump piston rod are to be metallized. The piston is rotated at 35 surface ft. per min., while the metallizing gun is fed at 0.125 in. per revolution. One such piston rod has been in service for 165,000 locomotive miles without wearing to renewable limits

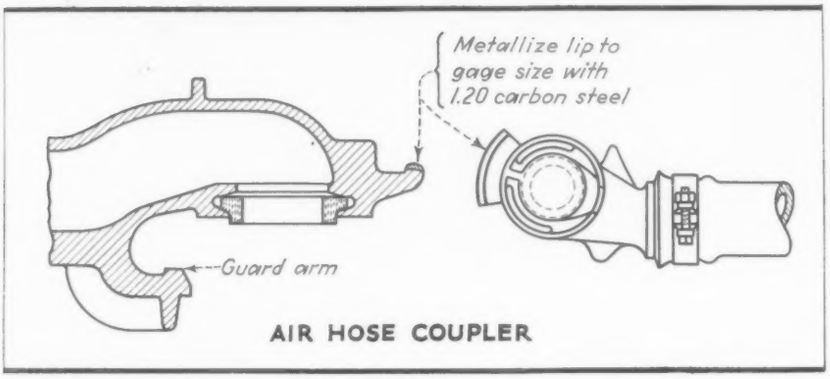
tons. There are two notable exceptions: crankshafts for booster engines and stoker engines. On one railroad this work was attempted after successfully metallizing crankshafts of diesel engines used in switching locomotives. The procedure for metallizing all of these crankshafts is as follows:

The crankpin and main bearings are ground down to permit spraying up to $\frac{1}{8}$ in. of metal, although in most instances the built-up surface is around $\frac{1}{16}$ in. when finished. Preparatory to metallizing, the journal surfaces are grit blasted, metallizing being done immediately following surface preparation to prevent accumulation of grease, dust, dirt or rust on the prepared surface which would affect detrimentally the perfect bond between the sprayed and parent metals. In practically every case, high-carbon steel wire is used to build up these surfaces. In one instance, where a wire of 1.20 percent carbon had been used, the sprayed area at the journal surfaces revealed a Brinell hardness of 380.

One railroad metallizing stoker engine crankshafts, prepares the surface by turning the journal areas with a sharp pointed tool and further rough-



Locomotive shafts, rods, and pistons are generally prepared for metallizing by first turning with a 60-deg. threading tool, and then flattening the ridges with a rotary tool. Parts are sprayed immediately after preparation to prevent accumulation of dirt, grease or rust that would affect the bond between the metals



Air hose and signal hose couplers, ordinarily scrapped when the lip wears below gage size, can be reclaimed at 3 percent of their original cost

ing the areas with a rotary shaft preparation tool. Another road using this same method of shaft preparation has had the stoker engine in service for 165,000 locomotive service miles. Upon inspection after this service, wear on the crankpins was insufficient to warrant remetallizing.

The crankshaft of a 600-hp. diesel engine used in a switching locomotive has been in continuous service for 16,000 hours after metallizing.

On another road, reverse-gear piston rods, metallized six years ago, have not yet worn down to limits requiring remetallizing. However, they have been trued up by grinding during shoppings.

Car Repairs

Metallizing is employed by some railroads for maintenance of rolling stock. One railroad has adopted as standard practice the metallizing of armature shafts of multiple-unit electric cars. In this case, the bearing surfaces are built up with the armature in place, resulting in a saving unequalled by other methods.

Another road has been reclaiming thousands of air hose and signal hose couplers by building up the lip with sprayed metal. Engagement and disengagement of these couplers causes the lip to wear down below standard gage size, and unless the lips can be restored, the couplers have to be scrapped. The lip is cleaned by grit blasting, and built up to gage size by spraying with 1.20 percent carbon abrasive-resistant wire. This reclamation is accomplished at 3 percent of the original cost of the couplers.

Shop Equipment

It is interesting to note from the table that railroads, notable for their use of shop facilities to repair and rebuild machine tools and shop equipment, have used metallizing extensively to facilitate this work. Following are some of the parts metallized: machine tool spindles and press fits for gears; hydraulic pump plungers; washout pump piston rods; pistons and valve rods for air compressors; armature shafts of shop-machinery motors; shafts and bearings of centrifugal pumps; fan-engine piston rods; and emery belt rollers for flue polishers. Some of these parts have given over six years continuous service since metallizing, which, in a few cases, *is equivalent to*, and in other cases longer than, the service obtained from the original part.

Best results are obtained with this process when one or more machinists have been trained specifically in metallizing technique. Furthermore, the successful application of metal spraying is obtained after each individual job had been studied carefully to determine whether or not the service conditions to which the part must be subjected will or will not have any detrimental effect on the bonded surfaces.

Limits Use of Scarce Metals

In many instances, wires for metallizing are now under priority control, because of the scarcity of certain elements. Several railroads recognizing this fact have been spraying the base of metallized parts with non-priority metals and using limited amounts of wire containing scarce elements on the surface of the parts. Thus, in the manufacture and maintenance of parts for motive power and rolling stock, the amount of priority metal needed may be reduced to a fraction of that usually required. This procedure is now becoming standard practice for metallizing.

PARTS METALLIZED IN LOCOMOTIVE SHOPS

STEAM LOCOMOTIVES:

Airbrake pistons.

Air compressor piston rods.

Air compressor governor valve stems.

Booster-engine crankshafts.

Corroded ashpan plates.

Elesco exhaust-steam injector parts: Nozzles, overflow pistons, water valves.

Elesco feedwater-pump piston rods.

Headlight generator shafts.

Power reverse gear parts:

Pistons and valve stems. Screw, sleeve, shaft and trunk of Precision reverse gear.

Stoker-engine crankshafts.

Stoker conveyor-screw bearings and bushings.

Valve stems.

Worthington feedwater-pump bucket spindles and piston-rod tubing

FREIGHT AND PASSENGER CARS:

Airbrake pistons.

Air hose and signal hose couplers.

Armature shafts for multiple-unit electric cars.

DIESEL ENGINES FOR SWITCHING LOCOMOTIVES:

Crankshafts.

Exhaust-valve stems.

Fan pulleys and shafts.

Generator and armature shafts.

Pistons.

Water-pump housings—interior to prevent corrosion.

Water-pump shafts.

Water-chamber side of cylinder liners to prevent corrosion.

Water-tank interior to prevent corrosion.

SHOP EQUIPMENT:

Axles and bearings of material-handling trucks.

Bearings for grinding wheels.

Centrifugal-pump shafts, bearings.

Clutch housing for heavy shears.

Emery rollers for flue polishers.

Fan-engine piston rods, valve stems.

Gear fits on machine drive shafts.

Hydraulic press rams.

Hydraulic pump plungers

Locomotive cylinder and valve-chamber boring bars and spider bearings.

Machine tool boring bars.

Machine tool spindles.

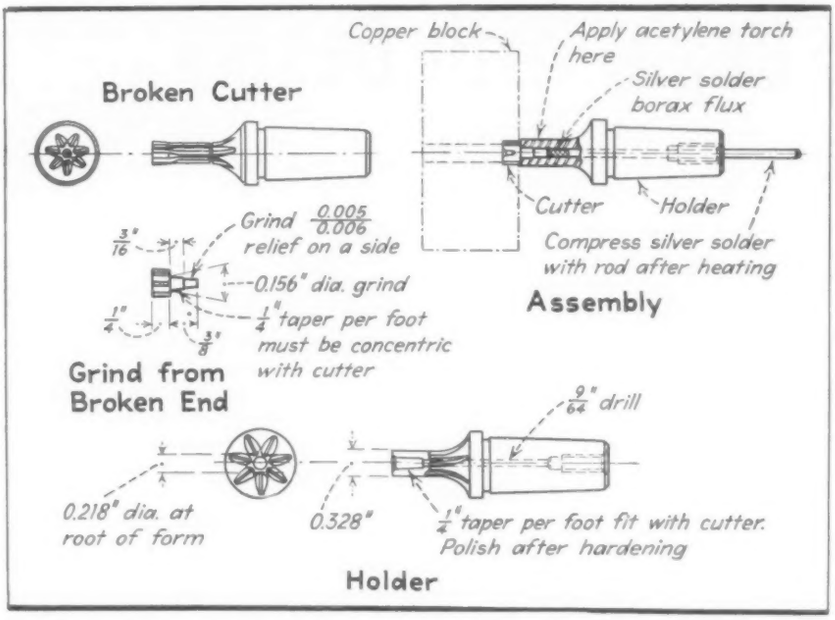
Motor armature shafts, bearings.

Power plant steam engine pistons and valve rods.

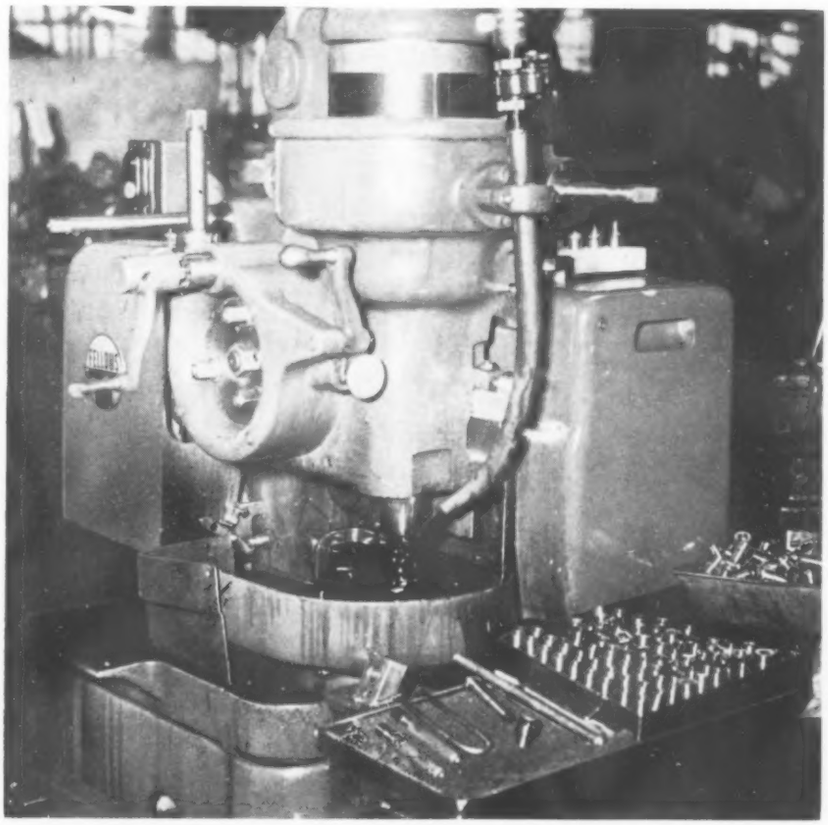
Rotor slip rings on shop motors.

Washout-pump piston rods, valve stems, and plungers.

Repair Adds Life to Spline Cutter



Quick repair of a broken tool was effected by working out a stronger cutter body into which the reclaimed tool tip was silver soldered



Production of fuel-pump drive couplings faced indefinite shut down when the only internal-spline gear shaper cutter on hand was broken

The repair of a broken cutter used the old tip brazed to a heavier shank which produced a better tool than the original

BREAKAGE of perishable tools becomes especially serious if the only available tool for a specific operation came with the machine and a replacement is unobtainable for months.

Recently the Chevrolet Bay City plant was faced with the prospect of a lengthy shut down in production of fuel-pump drive couplings for an aircraft engine unless it could repair a delicate internal-spline gear-shaper cutter. The tool had broken in the shank section, which had thin webs and a small root diameter to give wheel clearance when sharpening.

The tool design department decided to make a new tool by machining the tip from the broken cutter and inserting it in a stiffer shank. Final design of the shank called for a spline form approximately 0.005 in. undersize on the contour with respect to the cutting tip. Thus, the fins on the holder just clear the internal spline teeth on the tip, the root diameter is much larger than the original, and the shank is at least three times as stiff as the original.

To hold the tool tip in the new cutter body, a two-step taper plug was ground on the broken end. The $\frac{3}{16}$-in. step nearest the tip was made a press fit in the cutter body, and the balance was ground 0.010 in. undersize to permit entrance of silver solder.

To assemble the tool, the tapered plug on the tool tip was pressed into the cutter body, and the splined end was pressed into a hole drilled $\frac{1}{32}$ in. undersize in a copper block. The copper block dissipated soldering heat rapidly from the spline teeth, so as to avoid drawing the temper.

For soldering, a rolled-up strip of silver solder and borax flux were pushed down the $\frac{9}{64}$-in. hole through the cutter body. Heat was applied to the shank of the cutter body by means of an acetylene torch. A rod inserted in the hole served two purposes: (1) to force the silver solder into contact with the tool tip, and (2) to ascertain when the solder melted.

Production experience with the reclaimed cutter indicates far greater life than obtained with the original tool.

Savings Begin With Design

BY H. R. HAGEMAN

Parts of blanking and forming dies subject to misalignment and wear should be designed for quick repair or renewal

THE AVERAGE TOOL for bending and forming small and medium parts from sheet or strip stock apparently is not subject to as many maladies as are cutting dies; however, there are a few details which if not taken care of at the right time are likely to increase die maintenance costs.

The factor most frequently encountered is the tendency of the steels to wear out of shape rapidly and form the part incorrectly. The obvious remedy is to design the tool so that the sections subject to the greatest wear can be readily replaced, preferably using abrasion-resistant steel for such sections. High-speed steel properly hardened will outlast the hardest carbon steel, especially for dies that require frequent grinding or polishing to prevent scratches on the drawn parts.

Some designers recommend rollers to be fitted into the corners of the steel to replace the stationary radius. Such construction is expensive, and is likely to cause trouble by clogging with dirt.

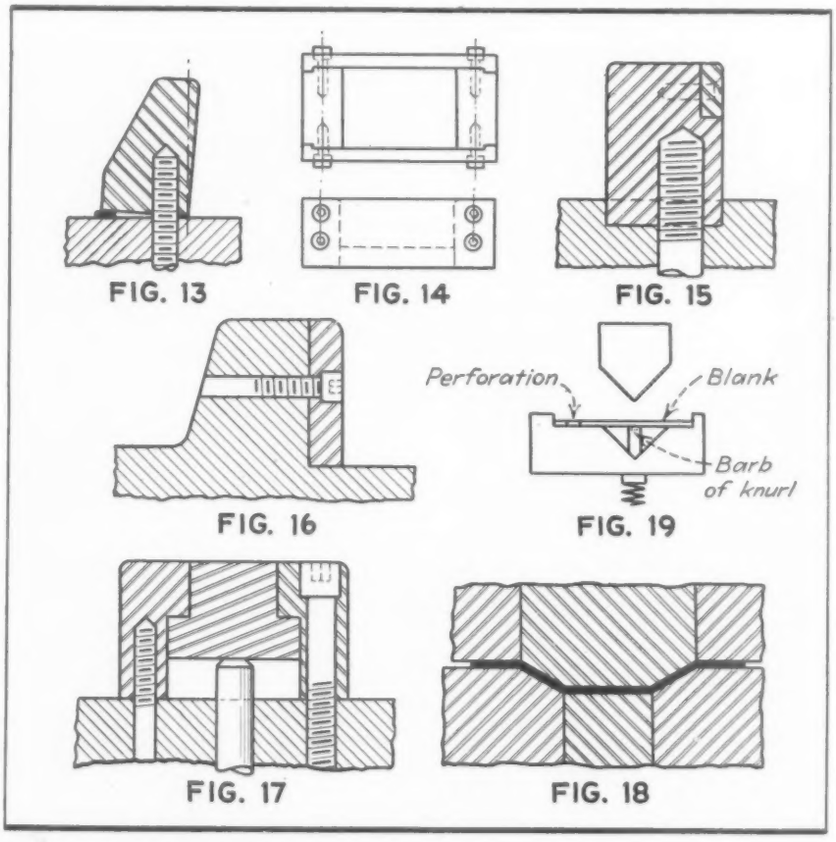
Dies used to round a corner, round a part which has been stiffened by a preceding bend or fold such as a square box corner, or round the ends of a semi-cylinder, are subjected to a gouging action that results in excessive wear. Such dies should be protected at such points by inserts.

Most simple forming dies for small work, with the exception of the break type, are modifications of the U-bending die, several of which are shown in one of the drawings. Fig. 13 is an exaggerated view of a make-shift method for obtaining more service from a worn non-adjustable die; the steel is simply tilted inward by placing a thin shim under the back edge. The dowel fit may have to be relieved if much tilting is necessary. The box-type construction shown in Fig. 14 is probably the strongest; in addition, the side plates keep dirt out of the tool and can be made to limit the rise of the pressure pad, thus eliminating the usual shoulder screws.

In case it is impractical to use the side plates, the end blocks can be fastened as shown in Fig. 15, which is a serviceable construction. The replaceable wear block is a feature that often reduces die costs. The dowel pins are needed only in case the steel is not located lengthwise by the casting.

Where special iron castings are available, buttress blocks to prevent spreading strains can be cast integral with the die shoe as shown in Fig. 16. Tools of such design can be made cheaply, and when used appropriately will minimize die costs.

Some forming dies combine a lancing or extruding operation or both with the forming operation. In such tools the pressure pad acts as a stripper or shedder; if the material is fairly



Press tools for bending and forming small and medium parts if properly designed will decrease die maintenance costs. Abrasion-resistant inserts, buttress blocks and sectional dies as shown here can be used to advantage

heavy, considerable spring pressure will be required to raise the pad and it is liable to slam up hard and snap or break the shoulder screws. The clamps shown in Fig. 17 are a positive solution to this problem. Such clamps serve to close the sides against the entrance of slugs or other foreign matter which might cause mis-forming of the part or fracture of the press tools.

In designing forming dies for small parts, the steels must bear evenly on the part being formed in order to avoid variation in shape. Factors affecting properly formed parts are different tempers of the stock, and alteration of the shape of the tools caused by unequal wear at points subject to abrasion. With these facts in mind, the tools should be designed in sections if possible, and in such a manner that when one steel is relieved to take care of the natural spring back, its matching steel can be brought into bearing without grinding the entire formed surface as illustrated in Fig. 18.

Sometimes it is impractical to form a part in one operation, although at first glance it may seem simple enough. To avoid a complete rehandling of the part, it is frequently advisable to use a tandem die in which the part receives an initial form in one station and is transferred to another station on the same die for the final form, thus completing one part at each trip of the press. The die designer who realizes when it is best to specify a tandem die, instead of a single die, does much to reduce die maintenance costs.

The common form of V-bending die, shown in Fig. 19, should not be used for either single or double bends if the dimensions from one end to the center of the bend must be held to close tolerances, because the parts not only slip in spite of barbs designed to hold them, but they do not always slip the same amount or in the same direction. Many times a die that appears more expensive to build will prove otherwise on account of the elimination of "cut-and-try" work at the press.

Springs and Their Application

The way in which springs are used can be the cause of considerable trouble and expense. Small springs which operate the common type of finger stop on blanking dies should exert adequate pressure in both the required directions without help from the stationery department, and should be so attached as to require minimum adjustment each time the stripper is removed and replaced. Very little side pressure on the stop is required, since normally there is nothing to bind or retard that motion. However, if excessive side pressure is applied, it may destroy the resiliency of the vertical action of the stop. Some of the springs used are shown in Fig. 20, of which spring *A* is probably the most desirable.

Judging by the frequent failure of stripper springs, it would seem worth while to calculate the pressure required to strip a set of punches and specify the dimensions on the tool drawing. A common cause of failure is the use of springs that are too light for the job, necessitating excessive preloading which results in over-compression and breakage.

A helical spring of average length used for strippers will take a permanent set and shorten during service. When allowing for this when the die is built, preloading should be less than the length of thread on the stripper bolts so that the thread can be started without the use of an arbor press.

Stripper springs are usually placed in a counterbored recess through which the bolt passes. This is mainly for safety of the operator in case the spring should break. It would be better for the life of the spring if it were placed between the bolts in a special recess with a special stud for safety, if necessary, as shown in Fig. 21. This method provides space for longer and more lasting springs.

Springs for Limited Space

When sufficient space is not available in the die holder for the springs necessary for drawing, forming and heavy stripping, they are suspended underneath the die. The necessary preloading for such springs can be obtained by using a retaining nut on the upper end of the stud and lengthening the pressure pins accordingly as shown in Fig. 22. When springs are inclosed in pipe shields, the desired tension or preloading can be obtained by a screw through the pipe cap working against a disk placed under the end of the spring.

While factory tempered ribbon stock is readily available, flat springs should not be used except as noted previously in Fig. 20. Laminated springs will be found more efficient than the single-leaf type. The use of flat springs can frequently be avoided, and greater efficiency attained by recessing the moving parts to receive a coil spring, as in the stop pin shown in Fig. 23. A dual purpose arrangement that is liable to be broken in storage is shown in Fig. 24.

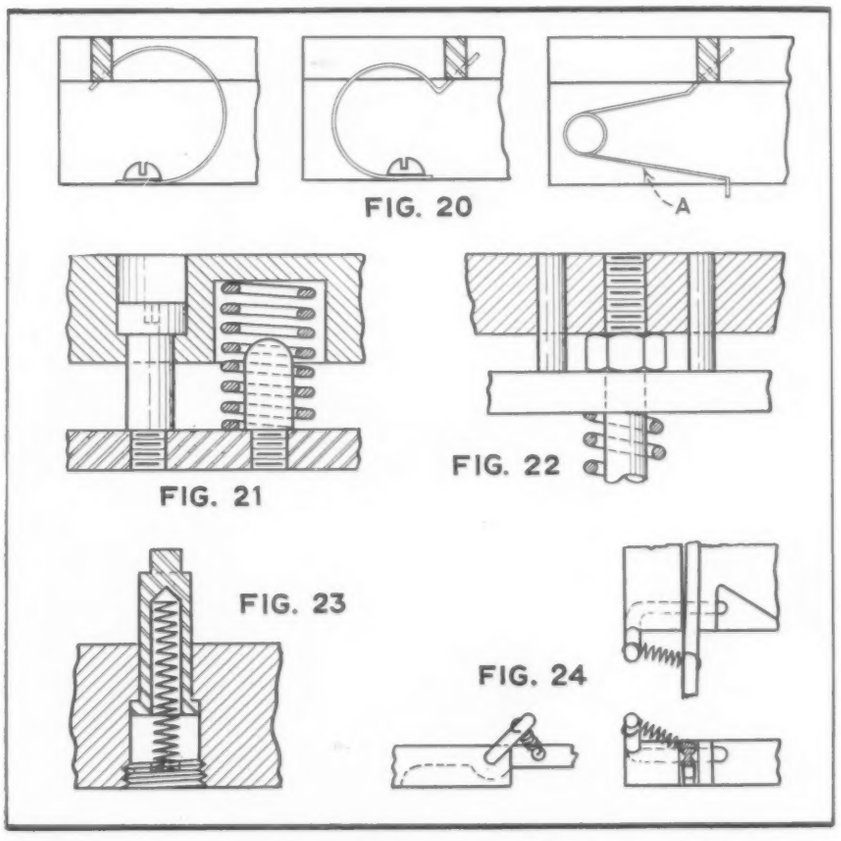


FIG. 20

FIG. 21

FIG. 22

FIG. 23

FIG. 24

The improper use of springs can play havoc with die costs. Some of the designs shown here eliminate excessive preloading that results in over-compression and breakage of the springs

Part 4 of this article will appear in an early number.

Are You Working With Plastics?

BY JOHN SASSO

II — Milling, sawing, punching and polishing can all be used successfully on plastics if the proper procedure is followed

WHEN MILLING molded plastic parts, speeds and feeds in the range used for brass are recommended. Speeds usually are 400 ft. per min., with carbon steel cutters and 1,200 to 1,600 ft. per min. with carbide cutters. Single- and double-bladed fly cutters are sometimes used at high speed with fine cuts. Where little material has to be removed, a high-speed woodworking shaper with a carbide-tipped tool can be used to advantage.

The same general rules that apply to turning, facing and boring operations also hold for milling parts molded from vinyl plastics. Standard cutters can be used, but higher speeds are feasible if extra clearances are ground on the cutter blades. Here again, it may be necessary to use an air blast to assure proper chip removal from the milling cutter. Wherever possible, it is recommended that helical milling cutters be used and that the number of teeth in the cutter head be such that at least two of them are in contact with the work at all times. Plain cutters are to be avoided, because of overheating caused by side friction. Milling cutters and blades should be given the same general care as turning, facing and boring tools to assure that a minimum of surface friction is developed during machining.

Separation and Distortion

Milling laminated plastics should never be done in a direction which will tend to separate the laminations. This is especially important in milling slots. In general, it is considered best to remove the full depth of material in a single cut.

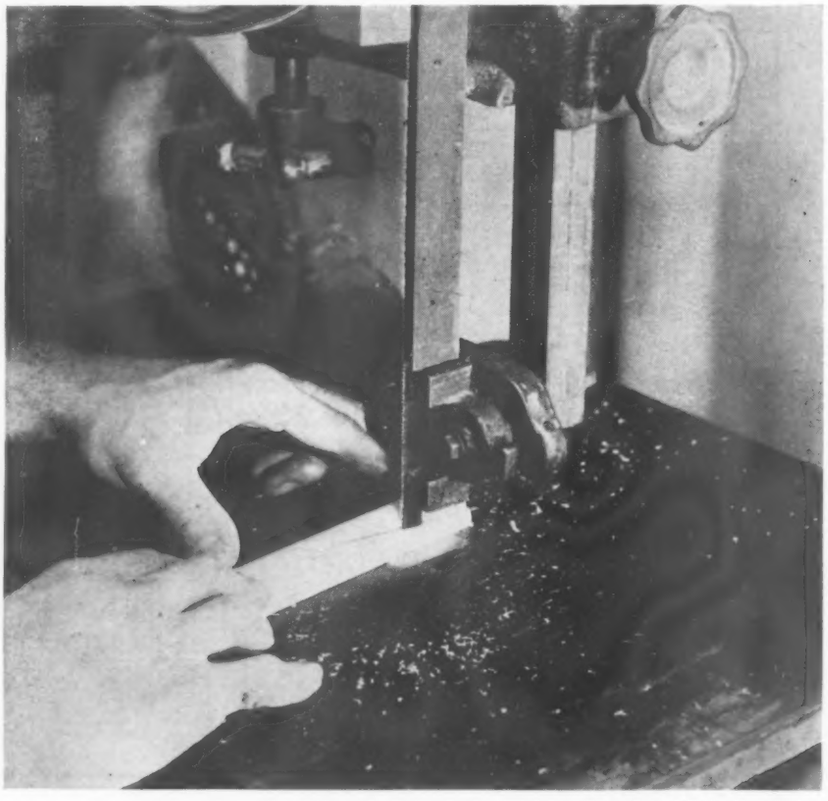
In designing fixtures for milling parts, it is essential that the fixture grip the work in a manner that will not cause distortion of the work. Since parts molded from plastic materials are less rigid than metals and thus more easily distorted, the stock should be well backed up during the milling operation and should be positioned so that the pressure of the milling cutter is against the backing. When possible, cutters should be operated so that the chips are discharged from the leading edge of the cutter in contact with the work. To use a cutter in this manner implies that the machine is in good mechanical condition. Considerably less friction is developed if the cutter takes the heavy part of the chip first, as in climb milling.

In cutting laminated blanks, the feed should be the maximum that is possible without showing marks on the teeth. A coarse feed tends to reduce wear on the cutting edges. In hobbing, it is not necessary to make roughing and finishing cuts, as a single cut to the required depth is all that is required. Hobs of 3 to 4 in. pitch diameter may be run at 140 to 310 r.p.m. with feeds of 0.040 to 0.080 in. On shapers, gears are cut at 100 to 130 strokes per min. with a fairly fine feed, unless both roughing and finishing cuts are taken. In the latter case, 0.010 in. of stock for finishing may be removed at any desired speed or feed. In all gear cutting, laminated stock should be backed up with wood or cast iron where the cutter breaks through the surface to avoid fraying or rough edges.

Saw Recommendations

The sawing of molded phenolic parts is done chiefly on circular and bandsaws. Bandsaws are recommended at times for straight cutting because they run cooler than circular saws.

Bandsaw manufacturers recommend saw teeth set to clear, some advocating one-half the thickness of the blade on each side so that saws give a width of cut double their thickness. Narrower saws and more set are needed for cut-



Courtesy Catalin Corporation

Handsawing of plastics is done with saws just soft enough to permit filing. Saws must be kept sharp

Courtesy Bakelite Corporation

Kick presses are used extensively for trimming injection-molded parts. A single-blade cutter is employed in the operation shown

ting curves than for straight cuts. Bandsaws, just soft enough to permit filing, are recommended but saws must be kept sharp. Dull saws cause chipping and might result in saw breakage. Sawing is usually done dry, but some recommend water for cooling. Saw teeth should have little set and eight to nine teeth per inch—and should run at 1,800 to 2,500 ft. per minute.

Number of Teeth

Sawing of polystyrene or cellulose acetate can be done with circular saws having nine to twelve teeth per inch for thin sheets and six teeth per inch for thicknesses over $\frac{1}{4}$ in. Saws 6 to 9 in. in diameter are run at speeds of 3,000 to 3,600 r.p.m. They should be hollow ground. They usually are $\frac{1}{32}$ to $\frac{1}{16}$ in. thick. A water spray gives a cleaner cut. One large saw manufacturer recommends that pieces be cut with a stream of water running in the kerf while the saw is cutting. This applies to both circular and bandsaws; otherwise, the thermoplastic materials will fuse. The circular saws recommended are 14 in., 12 and 9 gage, 130 teeth, 10-deg. rake, operated at 3,000 r.p.m. They are made of a special alloy steel stock.

For bandsawing, manufacturers suggest a bandsaw which is 19 to 20 gage, having 20 points to the inch, hardened and tempered. It should be operated at 4,000 to 4,500 ft. per min.

The most satisfactory method of sawing parts molded of vinyl plastics is with an underwater saw. When sawing unfilled resin, the equipment should be fitted with hardened saws. The surface speed recommended is 3,500 to 4,000 ft. per min. (1,200 r.p.m. for a 12-in. saw) and the saw should carry 10 to 14 teeth per inch. The teeth should have no set. An average of speed of travel through the stock is approximately 3 to 4 in. per min. It is possible, in some cases, to use feeds up to 12 in. per min. The finish of the sawed surface and the possibility of the stock chipping at the leaving edge are affected by the rate of travel of the saw through the stock, the sharpness of the saw, and whether the stock being sawed is a solid piece or several smaller pieces clamped together.

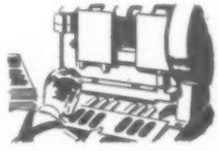
While filled resin compounds can be satisfactorily sawed with an underwater saw in a manner similar to sawing the unfilled compounds, the effective life of the saw is materially reduced by the filler. Fine-abrasive saws are preferable to metal saws. The abrasive wheels will produce an equally good finish on the sawed surface at a considerable increase in saw life. Rubber bonded cutoff wheels are not usable, but resin bonded wheels are perfectly satisfactory. Notching the abrasive wheel helps to promote self-cleaning.

For laminated stock, circular saws which are hollow ground and have no set generally are recommended where cuts must be smooth. Where rougher edges are permissible, saws with teeth set as for wood are satisfactory, this set making it unnecessary to hollow grind. Decreased set as diameter increases is advocated by some; others recommend radial teeth with zero rake. Chipping is caused by dull saws or by setting the saw too high or too low in reference to the table. Sawing usually is done dry, but some advocate water as a coolant. Smoother cuts sometimes are obtained by heating the material.

Press Work—Hot and Cold

Punching, blanking, shearing and shaving are done extensively on laminated plastics. Thickness of sheet, character of filler used, and temperature of the sheet are factors that determine the operations to be used. Some sheets can be punched cold, up to a certain thickness. Others require heating; usually the thickness which can be punched is greater when the sheet is hot. Heating can be done on hot plates or in ovens. The recommendations of the laminated supplier, both as to temperature and length of heating, should be followed. Some makes can be heated to as much as 280 F. without injury and others only to 250 F. Too high a temperature may affect the finish of the sheet and too long a heating may make it brittle. Punching should be done within 2 min. or less after heating.

Laminated materials yield somewhat



when punched. As a result, the hole produced is slightly smaller than the punch. Allowance of about 3 percent of thickness punched must be made for this in punching as well as in blanking. A very close fit between punch and die, approaching a sliding fit for cold work, is required. Stripper plates should fit

the punch closely to prevent lifting at the edge of the hole as the punch is withdrawn. Progressive dies are satisfactory but best results are secured with compound dies which place a spring load on the stripper. Blanking punches should be from 0.001 to 0.008 in. smaller than the size of blank required. Press speeds are about 150 strokes a min.

Punched blanks often have rough edges. This can be remedied by shaving in a hollow die with a 45-deg. cutting edge, which must be sharp, using a brass or soft steel plunger. Shaving is done hot as a rule, but can be done cold on some materials up to about $\frac{1}{8}$-in. thickness.

Warmed for Smooth Edges

Cellulose acetate sheets can be punched and blanked with sharp edge tools. To obtain smooth edges the sheet is warmed to about 125 F., but not enough to affect its polish. As the material is compressed by the cutting action one edge is concave and the other convex. This is hardly noticeable on thin sheets. Acrylics are blanked similarly with sharp edge punches, but heating to 180 deg. F. is recommended for this type of material.

Embossing, as in stamping or pressing letters, often is done in branding parts of plastics materials. Heated brass dies are used. The stock also is heated in some cases. Letters are often wiped in after embossing, but can be made to stand out readily by covering the area to be marked with metal leaf before embossing, the pressure causing the leaf to cling in the recesses where the pressure is applied. Kick presses often are used.

Cast phenolic blanks, previously heated until soft, are often pressed in steel dies to form a design on one surface. This sometimes involves a fairly deep impression requiring considerable

flow of material and may include punching of holes, as in buttons.

Ashing, polishing and buffing is done on nearly all types of plastics, either to improve the finish or to remove sanding or tool marks left by preceding operations. Ashing is done with wet pumice; polishing with special compounds containing wax and sometimes a fine abrasive.

For larger pieces, and some small parts requiring an extra fine surface finish, hand polishing or wheel buffing

Courtesy Bakelite Corporation

A multiple-cavity punch type trimmer is used in this kick press set-up for circular injection-molded parts. Kick presses also are used for embossing plastic products with heated dies

is necessary. The correct speed of lathes for phenolics and ureas, using a 10- to 12-in. diameter wheel 4 to 5 in. wide, is approximately 2,500 r.p.m. A speed of approximately 1,500 r.p.m. is used for styrenes and acetate materials. It is desirable to work with manufacturers of polishing supplies, as a certain amount of experimenting is necessary, depending upon the material used and the design of the part, to determine optimum speeds for different compositions and different wheel constructions.

Light Pressures for Buffing

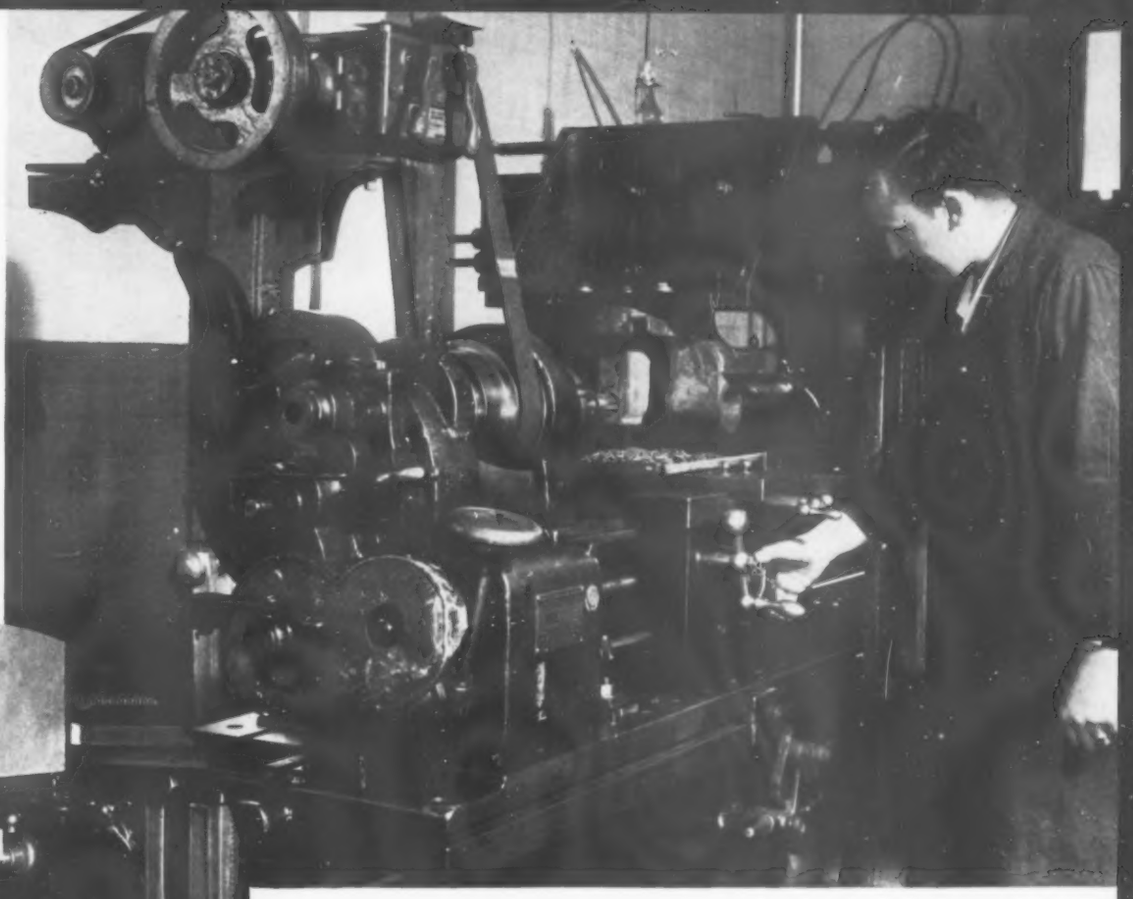
Articles molded from vinyl plastics can be buffed and polished with fabric wheels of the standard types. Precaution must be taken so only light pressures are used on the work. If the pressure is too great, sufficient heat may be generated to soften the stock and to cause sticking to the fabric wheel. For general purpose work a muslin wheel with $1\frac{1}{2}$-in. sewing, operating at 3,700 surface ft. per min., may be used.

Where appreciable amounts of stock are to be removed during a polishing operation, particularly for the removal of wheel or machining marks from unfilled compounds, it is best to use a cutting compound on a loose cotton wheel operating at about 6,100 ft. per min.

If the polishing operation can be preformed wet, good results are obtained with a suspension of finely divided pumice in water and a loose muslin wheel operating at a peripheral speed of approximately 6,100 ft. per min. A constant stream of water and pumice fed to the wheel produces the best results. This operation is similar to the ashing commonly used in the polishing of all plastics, and is the most effective way of obtaining a good luster on a production basis.

For laminated phenolics, grinding or sanding with No. 220 grit, cotton buffing wheels, with Tripoli or other polishing compounds, will restore luster. Buffing without prior sanding can be done with Tripoli to restore surfaces which have not been scratched too deeply in handling.

Thumbing in pumice and then in polishing compounds often is done on small plastic parts as a substitute for, or as a supplement to, wheel ashing and polishing. Tumbling also is done extensively to remove thin fins. As a rule, tumbling is done dry, but for cutting-down with pumice and for subsequent polishing on acrylics, tumbling in wet pumice is advocated.



This improvised boring machine was made by mounting an engine lathe on the table of a planer. Here it is reaming a casting that has previously been bored on the same machine

A channel was bolted across the planer uprights and the carriage was fastened to this

Boring Machine Built From Scrap

BY WILLIAM DZUS, PRESIDENT, DZUS FASTENER COMPANY

Unable to secure a horizontal boring machine, production was expanded by using an ingenious combination of lathe and planer

WHEN A FURTHER EXPANSION in the production of Dzus fasteners became necessary a few months ago, a horizontal boring machine was needed for work on a number of castings used in their production. Every effort to secure such a machine failed.

Attempts were made to subcontract the work, but no shop with the necessary facilities could do the work in less than about three months.

This shortage was filled by building in the toolroom a machine which will perform all of the operations of a horizontal boring machine. It consists primarily of a lathe mounted on the table of an old planer. The planer, which was about ready for the scrap drive, had been standing out in the yard for two years. The engine lathe used had been purchased second hand about ten years earlier.

The drive to the planer table was disengaged, and the lathe was mounted on this table. A channel iron was bolted between the uprights of the planer just above the top of the lathe carriage.

The lathe was carefully lined up on the planer table parallel to the planer ways, and the carriage was bolted to the crossbar. Since the carriage was now fixed, the action of the leadscrew caused the lathe itself to move back and forth, supported by the planer table.

The lathe used was a belt-driven model, but a motor drive was mounted on the lathe. An outside belt would have been impractical because of the travel of the lathe.

An angle plate was mounted on the crossrail. The work is mounted on the angle plate and can be adjusted by moving the crossrail. This improvised machine has available all the feeds and speeds of the lathe used, since the movement of the lathe is directly controlled by the leadscrew. Work that is too large to mount on the bottom of the angle plate can be handled by inverting the angle plate and fastening the work inside the top.

Production is about the same as could be obtained with a horizontal boring machine, and several months were saved in a critical operation.

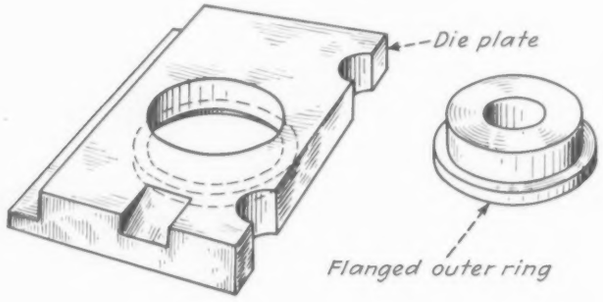
War Time SUGGESTIONS

The following ideas were selected from those recognized as meritorious by the Board for Individual Awards, War Production Drive. They are freely offered to industry as an aid to its war production.

Avoiding Press Breakdowns

Troubles from breakdowns on the presses for extruding radiator tubes used for cooling airplane motors was delaying production at the Winchester Repeating Arms Company. One cause of this trouble was that the extruding dies pulled out of the die plates and got under the descending punches.

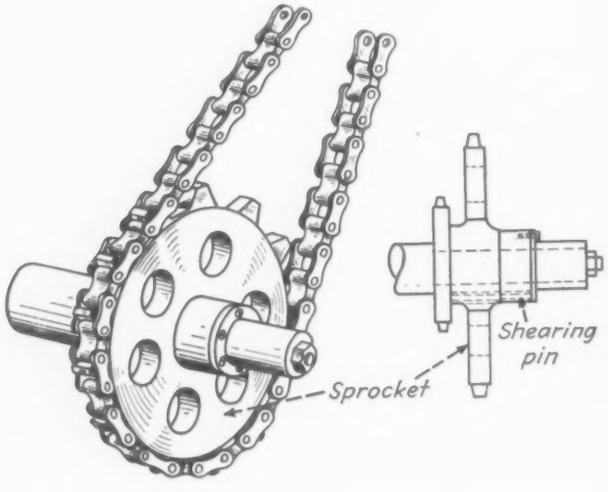
An operator suggested that the underside of the plate be



bored, counterbored and a flange be put on the outer ring which is part of the die. This secured the outer ring firmly to the die plate so that it could not be pulled through.

At the same time, a machinist was working on the problem from a different angle. His approach was to prevent a breakdown in cases where pulled dies or other accidents occurred. This was accomplished by freeing the drive sprocket from the drive shaft and providing an easily replaceable shear pin which would connect the sprocket hub to an auxiliary hub which was fastened tightly to the drive shaft. Should an overload occur, as happens when a broken die gets in the way, the pin would shear and the sprocket revolve freely on the drive shaft without turning the shaft.

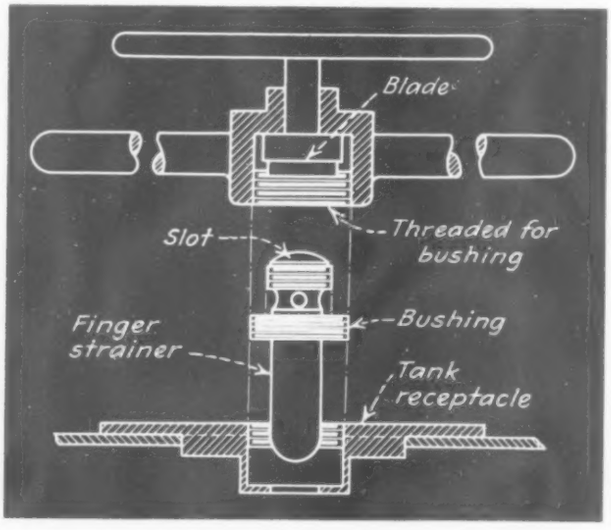
By adopting both these suggestions the trouble was eliminated. An annual saving in machine shop repairs and tools of several thousand dollars resulted and the lost time for repairs was eliminated. *Suggested by Allyn Broggi, operator, and Ralph Dellacamer, machinist, Winchester Repeating Arms Company.*



Wrench for Threaded Bushing

Strainers are threaded into bushings which in turn are threaded into a tank receptacle on fuel tanks at the Bell Aircraft Corporation. Since the bushings are threaded both inside and out and are flat on the top and bottom it is difficult to properly seat them. Difficulties with crossed threads were encountered in trying to put them in.

A combination wrench was designed which receives the bushing and the strainer and holds them while the bushing



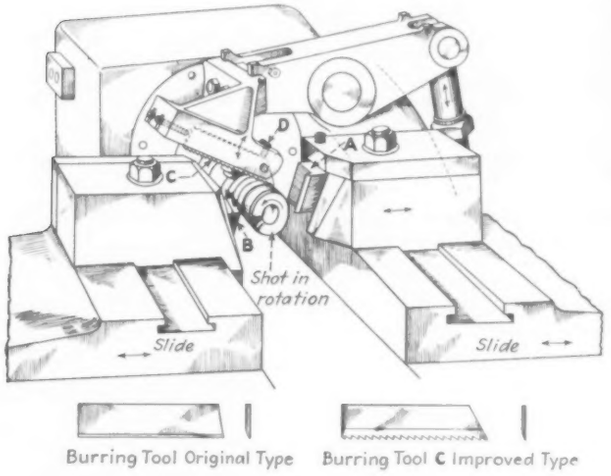
is worked into the tank receptacle. The wrench is in two parts which are free to turn separately. The outer part is threaded to screw loosely over the outside of the bushing so that the bushing can be screwed part way into it by hand. The inner part has a blade to engage a slot in the top of the finger strainer.

To use the wrench the bushing and strainer are screwed partly together and the bushing is screwed into the threaded portion of the wrench. The inner part of the wrench is then turned to back out the strainer until by pressure against the blade it locks the threads. The wrench can then be used as a unit to handle the bushing. When the bushing has been started the strainer is run back down into the bushing which releases the threads and the bushing and strainer can be completely screwed into position. *Suggested by Marvin Crawford, Bell Aircraft Corporation.*

Burr-Removing Tool Improved

A better burring tool has been applied to the band finishing operation on the 37-mm. projectile. In the set-up illustrated, with the shot turning at high speed, the cam actuated tool *A* rough turns the band to within 0.008 in. of the required final diameter. It also turns the base end of the band to the correct length.

Immediately following the roughing operation the cam-



actuated tool *B* finish turns the band, the center groove and the correct length on the bourrelet end. At the same time a rocker arm causes burring tool *C* to move vertically into the groove at the base end of the band until in contact with the hardened shot, removing excess gilding metal and burrs from this groove.

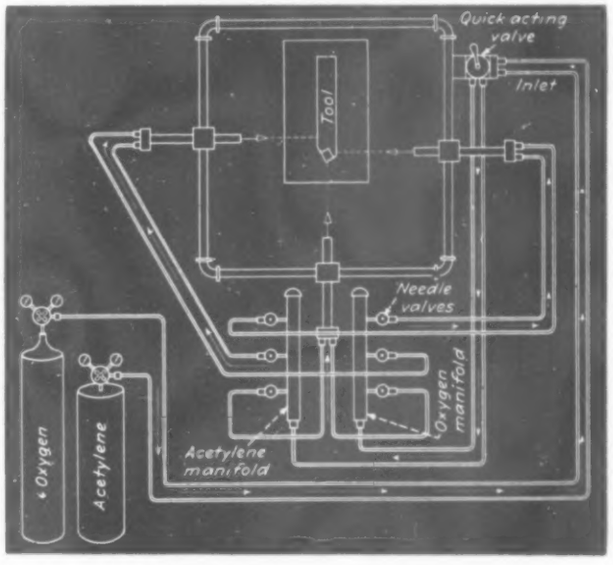
The straight burring tool formerly used has been replaced with a sawtooth tool. When a newly ground tool of this type has been installed in the band finishing lathe, only one tooth actually performs the burring operation. After this tooth has become dull, a slight tightening of the adjusting screw *D* will bring the first tooth back into action together with the second tooth. When these become dull, the adjusting screw is again tightened to bring three teeth into action.

This process can be continued until perhaps five or six teeth are functioning, at which time it becomes necessary to replace the dull tool. Use of this arrangement reduces the number of tool exchanges and consequently the down time of the machine. *Suggested by William M. Peck, Tokheim Oil Tank & Pump Company.*

Three-Torch Setup for Tool Brazing

The brazing of carbide tips to tool shanks was done by hand torch and electric furnace at the Christy Park Works of the National Tube Company, but the results were unsatisfactory because of the presence of scale, and tips were breaking because of poor brazing.

The three-torch arrangement shown in the drawing was



developed for this work. From the oxygen and acetylene tanks the supply passes through regulators to a quick-acting valve and then to separate manifold pipes. From these manifolds the gas escapes through needle valves to three blowpipes. These blowpipes are mounted on swivel holders to permit vertical and horizontal adjustment.

The tool shank is placed on a fire brick, and the three torches are located so that one flame strikes the front of the tool and one strikes each side. The two side flames are slightly staggered, one being closer to the tool tip than the other. The gases are mixed in the blowpipe and passed to the torch tip. A tip is selected to suit the size of the shank.

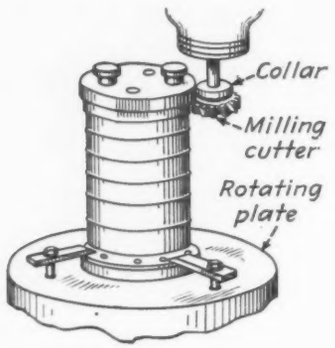
An excess acetylene flame is used to avoid oxidation. The flames are kept a good distance from the tool shank to allow for heat radiation and to avoid melting one spot in the tool because of over-concentration of the heat. The flame is aimed low on the tool shank, allowing the heat to radiate up to the carbide tip, to prevent cracking the tip. With this arrangement, copper, bronze or silver solder with regular fluxes may be used. *Suggested by Herbert R. James, Christy Park Works, National Tube Company.*

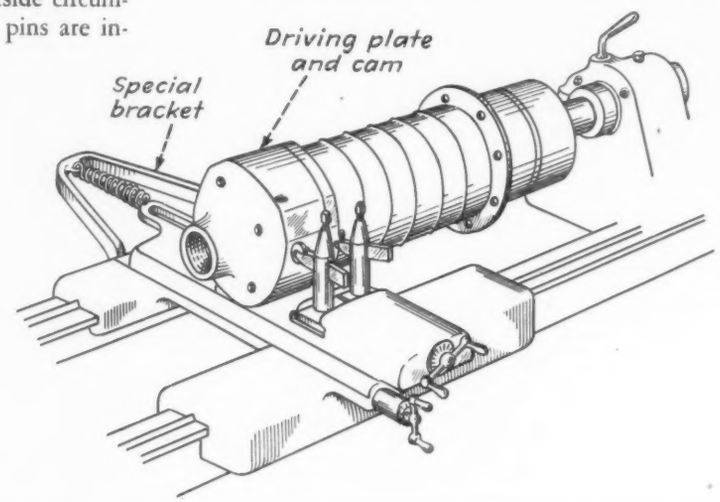
Machining Top Plates on a Lathe

Formerly the outside circumference of the top plate of cylinders was machined on a vertical mill. The cylinder was clamped to the turntable and a collar which served as a cam was fixed to the top. On the spindle and above the gang milling cutter was a circular collar turning free on the spindle and rolling on the cam. The cylinder was rotated by a hand feed crank and moved into the cutter with the longitudinal feed. This method required the use of both hands throughout the operation. The output was 40 pieces per shift, and frequent breakage of milling cutters resulted.

It was suggested that this operation be performed on an engine lathe. A driving plate made with a taper shank to fit the spindle of the lathe is used, and the outside circumference of this plate acts as the cam. Driving pins are inserted in the plate and the live center is put in the tailstock. Both the taper attachment and the cross feed of the lathe are disconnected. A bracket was made and fixed to the bed to hold a spring which was connected to the cross-slide. Two toolposts are used, one holding the toolbit, the other the cam follower. The tension in the spring keeps the toolbit against the cylinder top plate and the roller against the cam. The cutter is fed into the stock with the automatic feed of the lathe.

With this new method output has been increased from 40 pieces per shift to 65 pieces per shift, and a simple turning tool is used instead of a milling cutter. *Suggested by Richard Bone, assistant foreman, and John M. McQuade, job setter, Marine Engine Division, Packard Motor Car Company.*





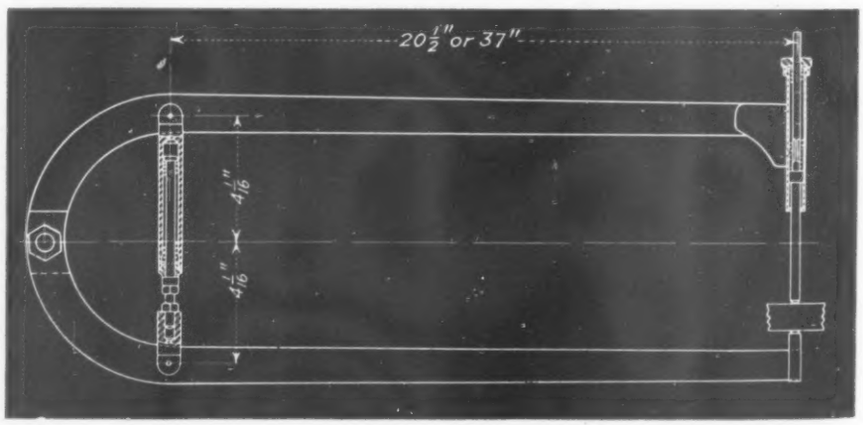
Thickness Calipers

Incoming castings of one design were tested with difficulty at the RCA Manufacturing Company. Available measuring devices could not accurately measure the wall thickness and many of the costly castings were rejected by the inspectors as faulty.

One inspector designed and built special calipers for accurately measuring this thickness. These calipers not only speed up the inspection operation, but have made it possible to reclaim castings previously rejected.

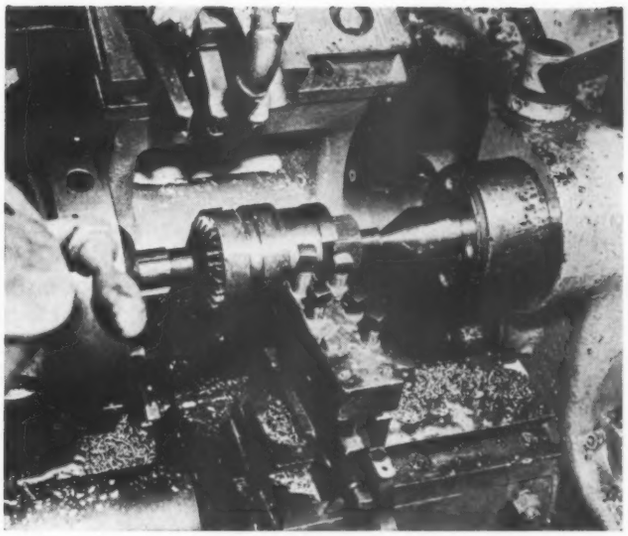
The calipers, as shown in the drawing, are hinged at a rivet at the end opposite the measuring tips. Near the hinged end is a spring piston which tends to close the calipers against an adjustable stop formed by two nuts on the threaded part of the plunger. The calipers are opened, compressing the spring in this piston, placed over the intervening obstructions and closed against the wall to be measured, until the piston strikes the stop.

One of the hardened tips at the end of the calipers is fixed and the other is movable. A compression spring holds the movable one against the fixed tip or against an intervening wall surface. To the movable tip is attached the scale. The reading is taken directly from this scale when the calipers are closed over the wall of the casting to be measured. *Suggested by Stanley Crawford, incoming material inspector, RCA Manufacturing Company, Inc.*



SUGGESTIONS ★ ★ ★

OLD METHOD



NEW METHOD

Arbor Holds Two Parts

A general drive coupling ring was turned on a standard lathe at the Yellow Truck & Coach Manufacturing Company, and then chamfered in another operation on another machine. It was suggested that two coupling rings be combined on a splined arbor and the entire assembly mounted in an automatic lathe.

In the picture showing the old method a single coupling ring is seen in the foreground in addition to the one mounted in the lathe. The other picture shows the set-up in an automatic lathe with a special tool. In addition to turning the two coupling rings at the same time, the chamfering operation is also completed in the same operation. *Suggested by LeRoy Pyles, Yellow Truck & Coach Manufacturing Company.*

Pilot Holes Prolong Tool Life

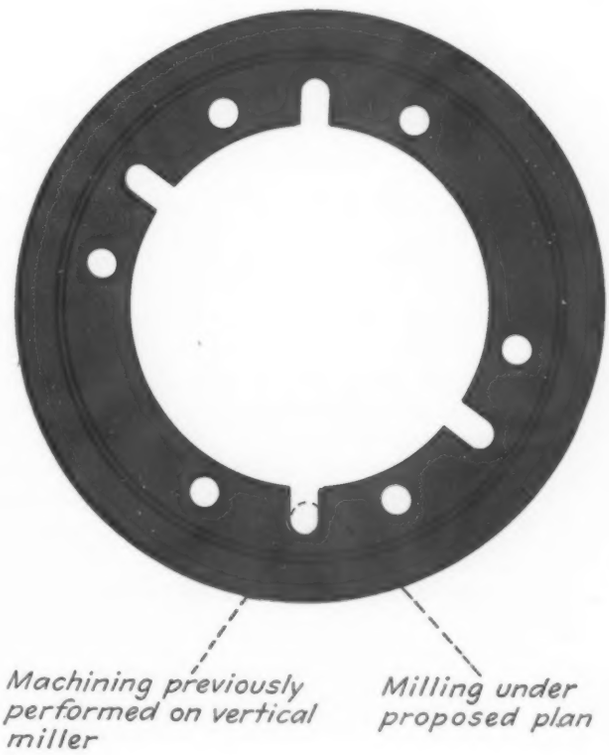
The center bearing shaft support for an aircraft engine has six drilled holes and four slots. The slots are 0.560 in. in diameter, 0.375 in. deep, and 0.675 in. long. They were formerly cut from the solid with an end mill.

This is a very heavy cut for this size of mill in this tough metal; the cutter has a tendency to walk or climb which results in a crooked slot which does not fit the mating part.

It was suggested that four holes be drilled with a 0.500 in. drill at the center point of each slot to remove all excess stock and leave approximately 0.030 in. on a side to be removed by the mill. This procedure greatly relieves the strain on the end mill which then cuts a straight block and increases the life of the tool 90 percent.

The time for the milling operation was reduced from 40 min. per piece to 6 min. per piece. Since the four additional holes are drilled with the same jig that was used for the six other holes, the additional time for drilling was only about 2 min.

New holes and bushings were added to the old drill jig so that the additional holes can be drilled in the same operation. The dotted line in the drawing shows the location of the additional holes and the saving they make in the amount of milling. *Suggested by Robert Petering, Wright Aeronautical Corporation.*



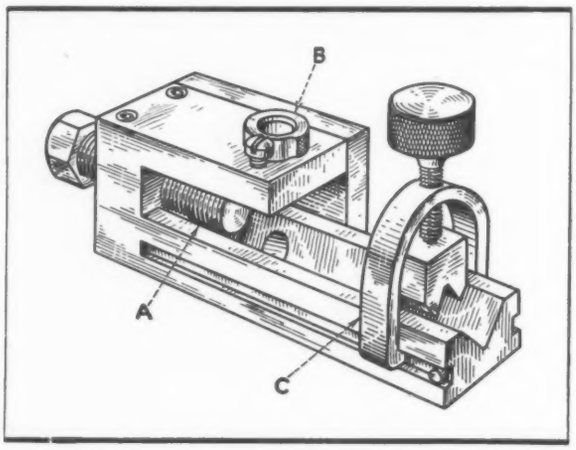
IDEAS FROM PRACTICAL MEN

Simple Jig for Accurate Drilling

BY OSCAR HEUER

Tubing for aircraft structures, as well as pipe sections for assembly jigs, often must be drilled accurately. The number of pieces drilled, as well as the location of the holes, do not as a rule warrant the fabrication of a jig for each section; however, the accuracy demanded necessitates the use of a jig.

In the illustration is shown a jig designed to handle tubing and pipe of various diameters, the location of which can be varied from the end by an adjustable



This drill jig is used by one aircraft company for drilling tubing for plane structures as well as pipe sections for subassembly fixtures

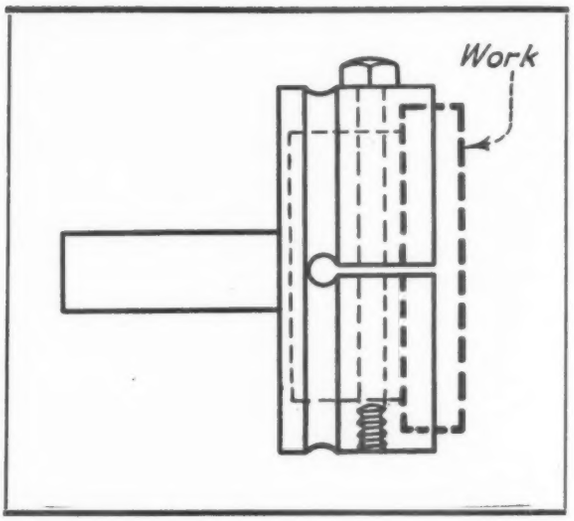
stop *A*. The tubing or pipe rests in a V block to which is bolted the auxiliary members carrying drill bushing *B*. The V-block has milled slots along its sides for adjustment of clamp *C*.

This is the simplest drill jig of this design used by one aircraft company on Long Island, N. Y. Other jigs of the same basic design are used with longer V-blocks and multiple drill bushings for drilling pipe and tubing requiring equally spaced holes along their length. These jigs are made from low carbon steel, with the drill-bushing plate ground parallel at all contacting surfaces. The drill bushings are made from high-carbon steel hardened at 1,525 F. and drawn to a Brinell hardness of around 200 after water quenching.

Chucks for Second Operation Work

BY ARTHUR G. RANSLOW

The chuck shown in the drawing was made and used for a second operation, that of facing off gear blanks that had to be kept within a tolerance of plus



A simple chuck for accurately holding second operation work can be made in the shop in a few hours

or minus 0.0005 in. The blanks were made of aluminum and brass in a turret lathe, the cutoff tool could not hold the close limit required, so the blanks were left about 0.010 in. thicker and faced in a second operation.

The chuck can be made of cold rolled steel and left soft, since there is no wear. A groove is cut around the outside of the chuck and two saw cuts are made as shown. A screw is run through the chuck at right angles to the line of the saw cuts so that a turn or two will tighten the chuck. The final cut on the holding jaw is made at the last, holding the shank end in a spring collet so that the holding surface will run true. The holding part of the chuck is made about 0.001 in. larger than the work. Only a few hours are required to make a chuck of this type.

Demagnetizer for Tool Bench

BY H. W. SECOR

It is frequently desirable to remove all traces of magnetism from steel tools and machine parts. Some of these parts are magnetized due to being machined in a magnetic chuck. The drawing shows a simple demagnetizer constructed from old transformer parts, plus a brass or other non-magnetic case.

Magnetized tools and steel parts are quickly demagnetized by passing the part over the top of the apparatus a few times. The rapidly alternating magnetic field destroys the permanent magnetic field which has been induced or registered in the hard steel tool or other part. The demagnetizer is plugged into any 110-volt a.c. electric light socket. A telltale lamp and

bullseye is built into the case, so that the workman knows when the current is on.

The core of the magnet is made of laminated steel strips taken from an old transformer core, or purchased from transformer and electrical supply houses. Several brass or iron rivets are passed through the core to keep the laminations from vibrating. A clamping member at the bottom serves to anchor the core and its magnetizing coil in the case.

The coil may comprise about 600 turns of No. 14 gage copper magnet wire. Flexible leads should be soldered to the coil terminals, and wired up to the telltale lamp and the control switch.

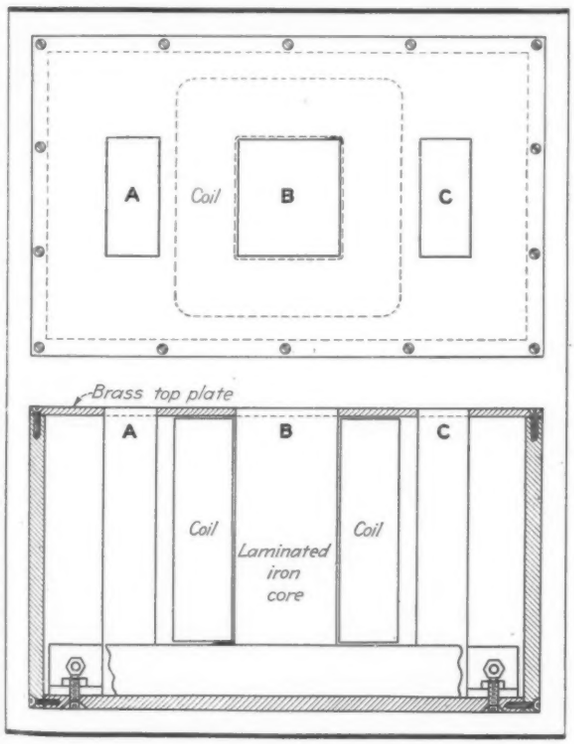
The brass top plate of the case has slots cut through it to pass the three cores or polefaces of the magnet. Copper or other non-magnetic metal may be used for the top plate, which is held in place by screws.

The coil may be wound on a wooden form slightly larger than the center leg of the magnet, and afterward taped with linen or cotton tape, then shellacked. For best results in a demagnetizer the iron or transformer steel sheets should be well annealed and as soft as possible so as to demagnetize quickly.

The part to be demagnetized is passed over the polefaces of the apparatus and back again several times. Finally, the tool or part is removed from the poles of the demagnetizer and drawn away so as to receive a gradually weakening a.c. magnetic induction, resulting in complete demagnetization.

In demagnetizing larger parts, the apparatus is slowly moved over the steel part, instead of moving the part itself.

Metal filings and chips can easily be brushed off the part, once it has been treated on the apparatus.



This demagnetizer for use in the shop can be built largely from old transformer parts

Dynamite Removes Broken Drills

BY FRANK N. MUELLER
Allis-Chalmers Manufacturing Company

Work salvage operations are especially important when the investment in material and labor has reached an advanced stage—for example, a tractor crankshaft in which a tool has been broken while deep-drilling oil-holes. From three to four hours of effort were consumed in removing a broken drill by driving a pin punch against the tool in an attempt to break it into pieces that could be shaken out of the hole. At best only a small percentage of crankshafts could be salvaged in this manner.

Extensive investigation disclosed that removal of broken drills from workpieces could be achieved in a speedy manner through the use of dynamite, although extreme caution must be used. In adopting this method

About two minutes are required to blast a broken drill from a hole instead of several hours to break it up with a pin punch. The trunnion-mounted boiler plate hood is swung down over the work to confine flying pieces

we chose a 40 percent gelatin explosive, which is mixed with sawdust on the job. The sawdust is essential to prevent the explosive from adhering to the wood paddle used to insert the mixture in the hole.

The amount of the charge depends upon the size of the drill to be removed, or to what extent it is wedged in the hole. For a $\frac{1}{4}$-in. hole, we use an explosive charge equivalent to a cylinder $\frac{1}{4}$ in. in diameter by $\frac{1}{2}$ in. long. Next a No. 6 blasting cap fitted with a 6-in. long Charter Oak fuse is placed on top of the charge. A safety fuse match is affixed to the end of the fuse and is either ignited with a match or scratched against a match box. If the drill is broken close to entrance of the hole, the charge must be pushed down the flutes, and the cap held in place with No. 40 modeling clay.

The workpiece is set up on wooden blocks upon a

steel table. A counter-weighted steel hood is swung down over the work after the fuse is ignited, to prevent material being thrown around the salvage department. The cover does not fit tight to the table; about $\frac{1}{4}$ in. opening all around is left so that air can enter, and the fuse will not go out. About 20 seconds are required for a 6-in. fuse to set off the charge. The drill is broken into small parts and blown out of the hole. The entire operation takes about two minutes. Success with this method of salvaging tractor crankshafts has led us to employ dynamiting of broken drills for other jobs.

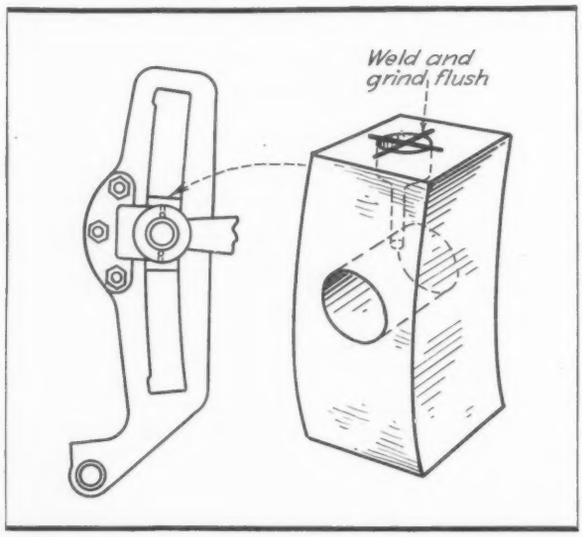
Complete equipment for blasting broken drills out of crankshafts cost about $50, and has paid for itself many times over. The method has proved safe in operation.

Extreme care is required with this method at all times. Laws regarding the handling of explosives vary in the various states but it is very important to store the blasting caps separate from the dynamite and also a safe distance away from where the actual dynamiting is being done. Always use care in the handling of the blasting cap so no shock or metal may come in contact with the loaded end of cap. It must be remembered that a safety-minded person must necessarily be chosen to handle explosives. It follows therefore that a certain amount of knowledge in the handling of explosives is of vital importance.

Welds Waste Retainers in Oil Cup

BY ARTHUR HAVENS

Many parts of locomotives and other machines are oiled from a reservoir in the top of the part. Curled hair or waste in the oil pocket used to retard the flow of oil is held in place by one or two lengths of straight wire across the top of the reservoir. Ordinarily, the part is drilled through and the wires inserted in the drilled holes and then riveted over on the ends.



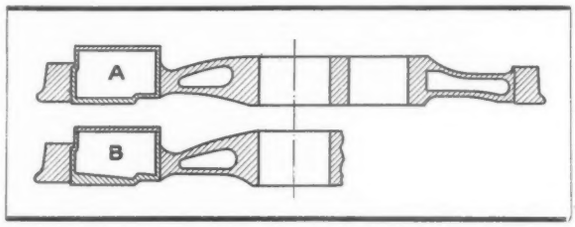
Wires used to retain curled hair or waste in oil reservoirs can be welded in place. This eliminates a laborious drilling operation when the wires are inserted in the part and riveted

A much quicker and simpler method of fastening these wires is as follows: Chip a narrow groove in the edges of the reservoir with a round-nose chisel. The groove should be about $\frac{3}{16}$ in. long and at least $\frac{5}{32}$ in. deep. Short pieces of $\frac{1}{8}$-in. wire are cut to the length required and laid into the grooves. These are tack-welded in place. The surplus metal can be ground away, leaving the job looking as if the wires had been inserted through the block. The job can be accomplished in one-tenth the time required for drilling holes in the part and riveting the retaining wires.

Suggested Change for Locomotive Counterbalance

BY H. W. STOWELL

Loose lead in the counterbalance *A* of locomotive driving wheels is a common occurrence, and mechanics often spend considerable time tightening it. There are several reasons why counterbalance lead works loose: unalloyed lead shrinks when cast in a wheel and becomes loose as soon as it cools; this contraction should be taken care of by making several pours and



Tapered instead of straight-sided counterbalance pockets for locomotive driving wheels effectively prevent the lead from pounding loose

pounding the lead each time as soon as it cools. Also, lead corrodes and disintegrates after a number of years in a wheel—looseness from this cause necessitates the pouring of new lead.

Although little can be done about the latter while the locomotive is in service, lead can be poured in the counterbalance to make and keep it tight. This can be accomplished by using the tapered lead pocket *B* shown in the drawing. Centrifugal force causes the lead to pack tightly in the tapered pocket, and it will not pound in the wheel when speed is reduced to a point where the centrifugal force will not overcome gravity.

At ordinary locomotive speeds, the centrifugal force in the counterbalance exceeds the strength of lead in compression. This no doubt explains the cracking and bulging of driving wheel counterbalances. To prevent such bulking and cracking, the walls of the counterbalance cavity should be about $\frac{3}{4}$-in. thick and well supported by ribs, stays or rivets. If the lead used for counterbalancing were alloyed with a small percentage of arsenic or magnesium, its hardness would be increased and bulged or cracked wheels and working lead would be avoided, especially if used in connection with the tapered pocket *B*.

Armament

SECTION OF AMERICAN MACHINIST

WELDING Plays Top Role in A.A. Gun Recoils

By JOSEPH L. AUER
Vice President & General Works Manager
R. Hoe & Company, Inc.

Use of welding positioners on a recoil mechanism aids the operator in turning out better welds in a shorter time. This set-up of a cradle, located by blocks on a positioner table, typifies the process

WELDING Plays Top Role in A.A. Gun Recoil

LARGE-CALIBER anti-aircraft guns are made up of four main subassemblies. These consists of the gun itself, the recoil mechanism in which the gun is mounted, the mount and carriage assembly, and the highly intricate fire-control apparatus. Each of these elements must be precisely made if the assembled whole is to function properly under the stress of battle.

One of the first educational orders for recoil mechanisms needed for anti-aircraft guns was placed with R. Hoe & Company, Inc. In peacetime a manufacturer of printing presses and other equipment used by the graphic arts industry, this company had a variety of equipment in its shops that was readily converted to the manufacture of parts for recoil mechanisms. Even more important, it had in its employ a force of skilled mechanics and supervisors experienced in the production of complicated mechanical assemblies. It was not difficult to get production started on the original educational order. In its wake, however, came production orders in rapid succession that have made it necessary to expand both the production facilities and the working force.

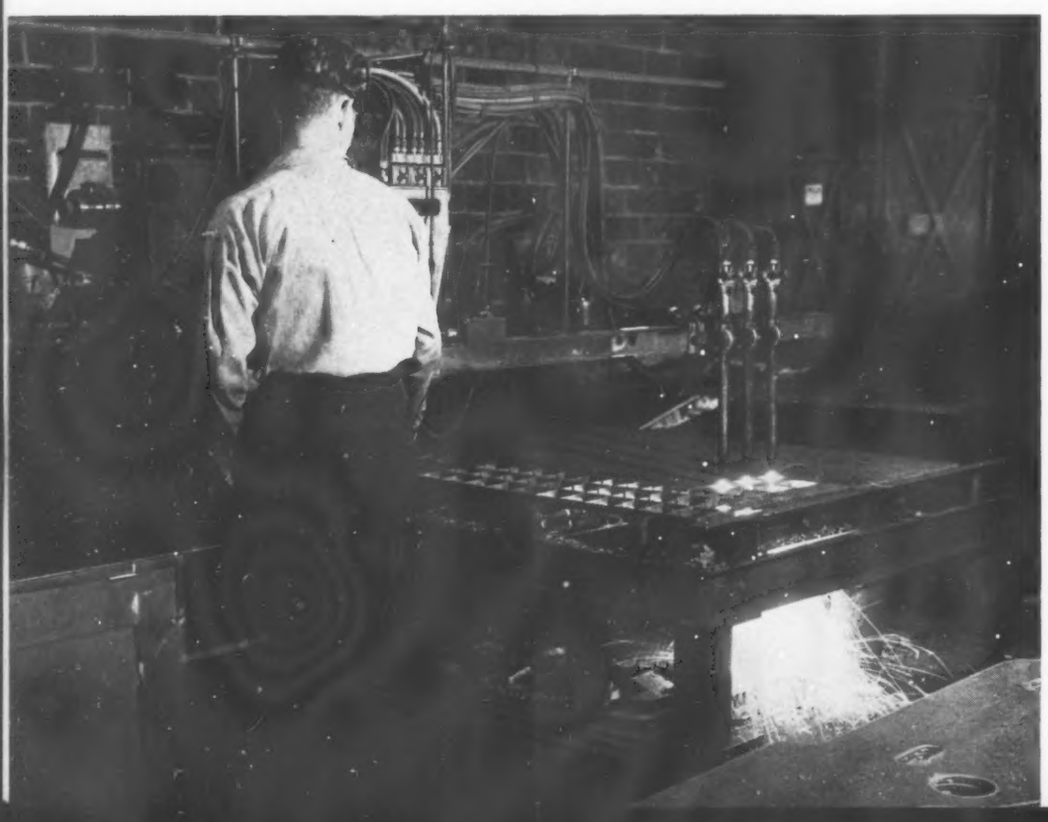
The largest expansion of the working force has taken place in the welding department, where the cradles for the various sizes of recoil mechanisms are assembled from shapes flame-cut or sheared from plate stock. Some idea of the amount of welding involved can be gained from the fact that one of these cradles requires more than 2,500 in. of arc welding. Considerable success has been achieved in training this expanded force of welders quickly.

Positioners are provided for all subassembly and final assembly welding operations, with the assemblies being tacked together in fixtures before delivery to the positioners. This has simplified the training of welders, as all welding, except some of the simple tack welds, is done downhand. In addition, all welding sets are Westinghouse 300-amp. transformer type units; operators are required to learn to operate only one type of welder.

Men hired for training as welders first spend a week assembling steel plate sections in the subassembly fixtures for tack welding and as they become familiar with the operations they are shown how to make simple tack welds. After spending a day or two learning how to handle the equipment, these beginners are gradually broken in on more difficult tack welds and the laying down of simple beads. As they gain in experience they are transferred to more difficult welding operations at the positioners in the subassembly welding booths.

Before assignment to more difficult welding jobs, where the welds must be checked by X-ray inspection, the student welders must pass standard welding tests and be certified by the resident Ordnance Department inspector. Our experience has been that most of the students can be trained to do a first-class job of downhand welding in three months time.

Conservation of material is practiced to an unusual degree in this welding department. Medium-gage shapes having straight sides are sheared from plate stock in a heavy-duty Cincinnati shearer. Sections of plate from which parts have been sheared are saved if they have sufficient area for reshearing to produce other shapes. Only very small pieces, not suitable for



Material conservation is the watchword in the department where small plate sections are cut for assembly by welding into cradles and other parts for recoil mechanisms. Both heavy-duty shears and flame-cutting machines are employed. The three-torch unit shown is used to cut a wide variety of shapes from plate stock. It is equipped with a magnetic tracer head which automatically follows steel templets

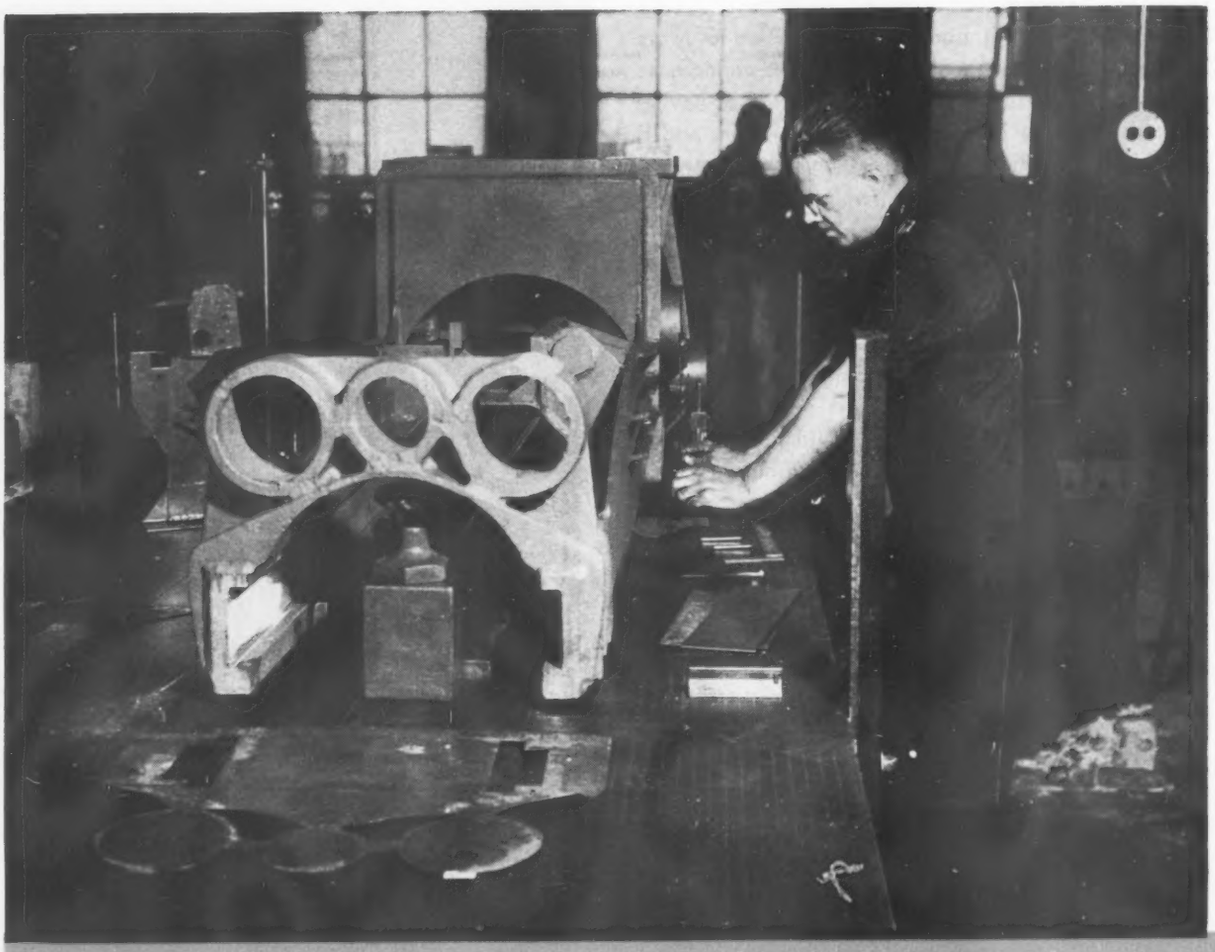
Subassemblies first are tack-welded and then transferred to hand-operated Ransome positioners located in individual welding booths. The division of work in the welding department has been found to increase production materially over the old method of having each man carry a job through to completion, and it facilitates upgrading welders as their skill increases

any required parts, go into the scrap box. Plate shapes of irregular contour are flame-cut in a three-torch Airco-DB Radiograph equipped with both a magnetic and a manual tracer head. Templets for standard shapes are made up by bending a small steel bar of rectangular cross-section to the required contour and then tack welding it to a mild steel sheet of sufficient thickness to prevent bending out of shape. With standard cutting tips, this flame-cutting machine is traversed through a cut at about 16 to 17 in. per min. This speed is increased to about 26 in. per min. when using high-speed cutting tips if the stock is relatively flat.

Fixtures for tack welding subassemblies and final assemblies are arc-welded on the job to suit the particular assembly. If adjustments must be made in the fixture to compensate for warping or misalignment in the product, these can be taken care of easily and cheaply. Because of the complicated nature of the welded assemblies that make up a recoil mechanism, it has not been possible to apply automatic machine

Each weld is checked both visually and magnetically to insure soundness. The dry-type Magnaflux test is used for magnetic inspection. Electrode points are placed at each end of a bead, but never more than 8 in. apart, and iron dust is applied over the weld while the current is turned on

Highly stressed welds in subassemblies and final assemblies are X-ray inspected at frequent intervals by shop and Ordnance Department inspectors to insure maintenance of weld quality. The gage shown is used to position the tube head in accurate relation with the work for these examinations



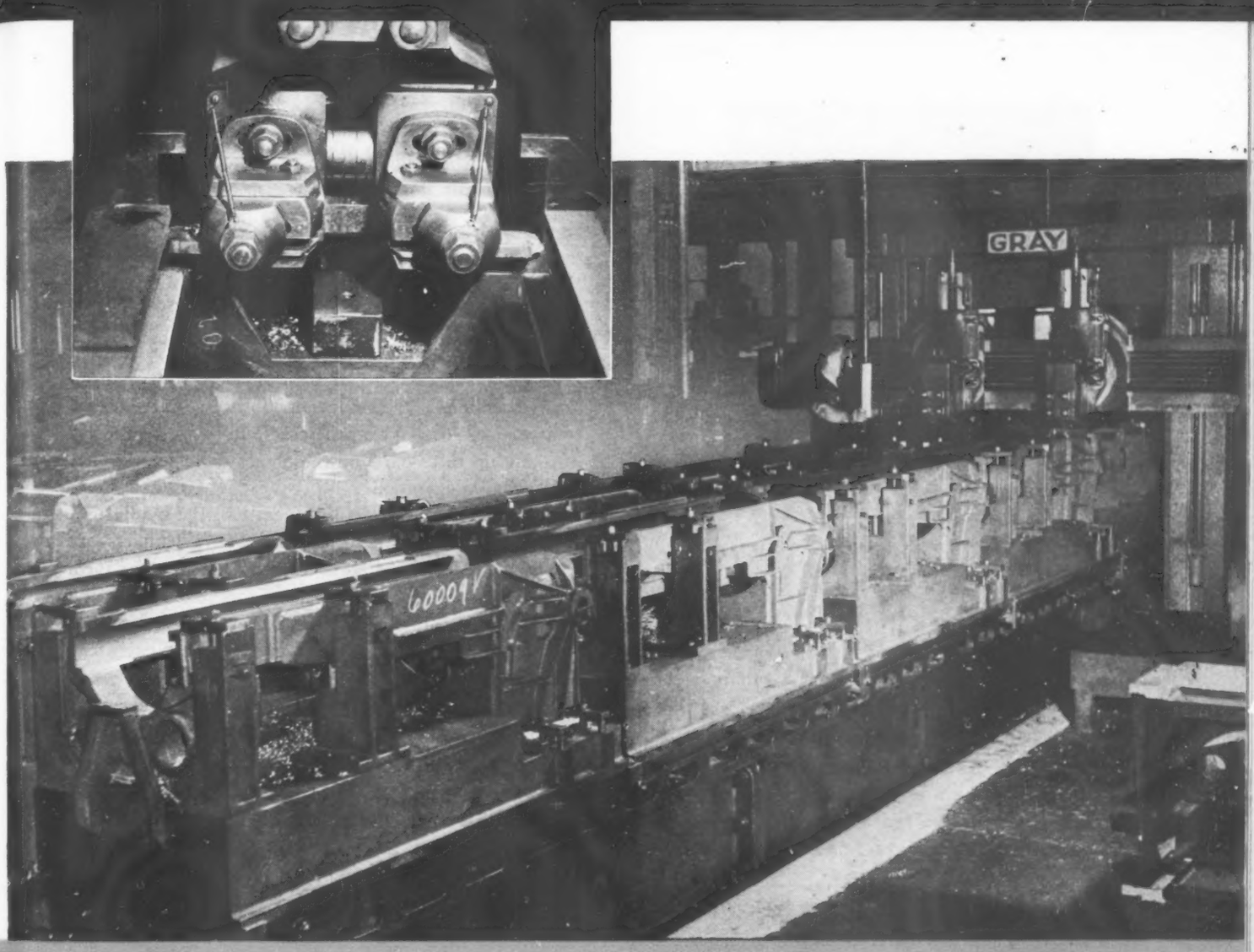
Time required for laying out cradle units for machining has been cut in half through the installation of this special table and by employing templets for checking the size and location of most of the elements. It is essential that each unit be checked to make sure that it will clean up in machining

welding in their manufacture. All welding is done by hand, with about 60 percent of the welds being single pass beads. High-stress joints are welded in two or more passes; it is these joints that are X-ray inspected from time to time by shop and Ordnance Department inspectors.

All welding electrodes are $\frac{3}{16}$-in. diameter, suitably coated for efficient welding. Stub losses are somewhat greater than is normally the case in efficient welding shops, since it is preferable to complete a bead without having to stop and replace the electrode in practically all of the welds. Stub ends longer than a predetermined minimum are given to the tack welders so that as many of them can be used as possible.

Welded subassemblies for recoil mechanism cradles and other parts are finish welded on hand-operated Ransome positioners. Power-operated units would not be justified here because of the relatively small size and light weight of the units. When finished, the subassemblies go to an inspection group for a careful check of weld quality and dimensional accuracy. Often this includes a trip to the X-ray room for side-plate assemblies and similar units that are highly stressed in use.

Power-operated Ransome positioners are used for final welding operations on welded cradle assemblies, which are tack welded in large fixtures before delivery to the curtained welding booths. The smaller assemblies need only one set-up on the positioner for the final welding operations, but two set-ups are necessary for the cradle assemblies because of the location of some of the required weld beads. Separate positioners are arranged for each of the set-ups on these assemblies. This permits keeping the necessary locating blocks and clamps for a given operation in place on the table of the positioner and has the added advantage of keeping the operator in a given booth experienced in making particular welds. He becomes



(Top) **Special small clapper boxes hold the high-speed steel tools used for planing ways at each side of the cradle in the same operation. These clapper boxes can be swiveled for positioning the tools**

Guide ways are planed in each side of the cradle units in a set-up which permits planing two rows of cradles at the same time. Fixtures are permanently mounted on the table of the planer for this operation

proficient because of familiarity with the given set-up and can be counted on to turn out consistently good welds. Furthermore, such an operator is less likely to miss a few beads in completing an assembly than if he had to do first one job and then another.

Experience has shown that the large cradle assemblies welded together from a large number of shapes of varying size and thickness have a tendency to warp or bow in certain directions. To overcome this tendency and produce an accurately aligned assembly the holding fixtures on the positioners in the finish-welding booths are set to draw the assembly slightly out of shape when the clamps are tightened before welding. When these clamps are removed at the end of the operation the assembly is drawn into proper alignment.

Finish-welded assemblies are looked over by an inspector and then loaded onto the car of a Surface Combustion car-bottom type furnace for a stress relieving heat-treatment. The heating cycle consists of bringing the load slowly up to a maximum heat of 1200 F., this usually requires about 8 hr. The load is held at this temperature for about 6 hr., and then allowed to cool in the furnace for about 8 hr. before the furnace is opened and the car withdrawn for reloading. While most of the individual parts that make up one of these welded assemblies are cut from relatively thin plate stock, there are some fairly heavy bosses cut from bar stock and the long heating cycle was selected to insure uniform heating throughout all sections of each assembly.

Heat-treated assemblies go to a Sly shotblast room for cleaning, then they are delivered to a final inspection group for checking. Here, each weld bead is inspected visually for blowholes, cracks and other visible defects, including unfinished beads, and specified beads are Magnafluxed to insure sound welds. In this group shop and Ordnance Department in-

Center-section strips on recoil mechanism cradles are face milled in this set-up on a Sellers horizontal mill. Dimensions must be held within plus or minus 0.002 in. Light cuts must be taken to eliminate chatter

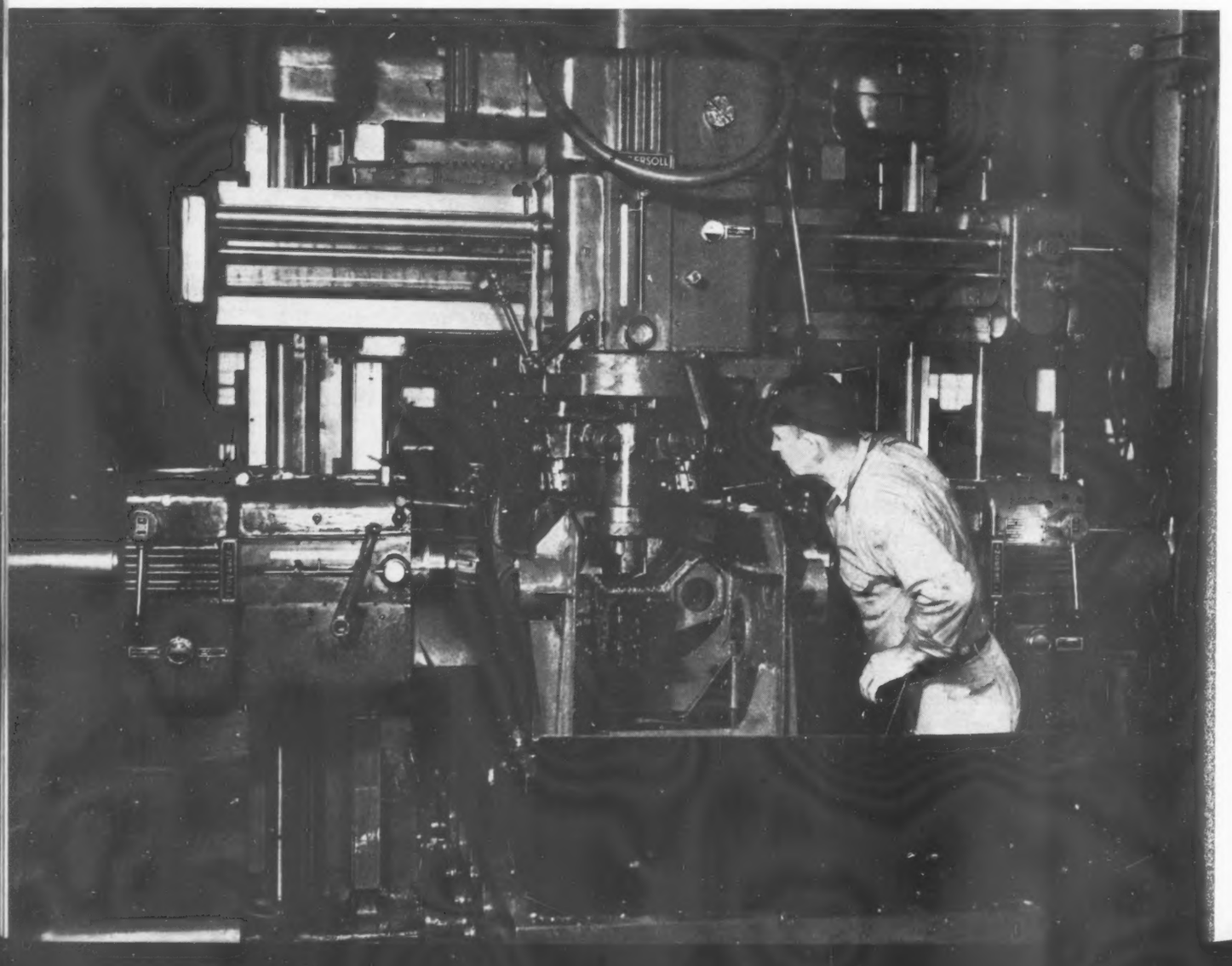
spectors work side by side to avoid the delays that would occur if two separate inspection groups were organized. When passed by the final inspectors, the welded assemblies are painted to prevent rusting and delivered to the machine shop by crane or truck.

Since the welded cradle units have a large number of pads and other surfaces that must be machined, each cradle goes to a layout table where it is checked to make sure that all of these surfaces will clean up in machining. At this layout table, lines are scribed at various locations on the cradle to assist in properly lining up these parts on the planer table for the first machining operation.

To speed up the layout operation, the cradle unit is centered above a fixed position and templets are placed against fixed stops on the table to align them with the various pads and other surfaces being checked. In addition, locating bars are fixed at several positions around the layout table so that gages can be employed to check the heights of various bosses.

When the cradles are set up on the planer table for the first machining operation, they are located

Special multiple-spindle heads on Ingersoll planer type millers are used for finishing many of the pads and other surfaces on recoil mechanism cradles. Design of these parts is such that vibration is set up if heavy cuts are taken. High-speed steel inserted-tooth cutters are employed

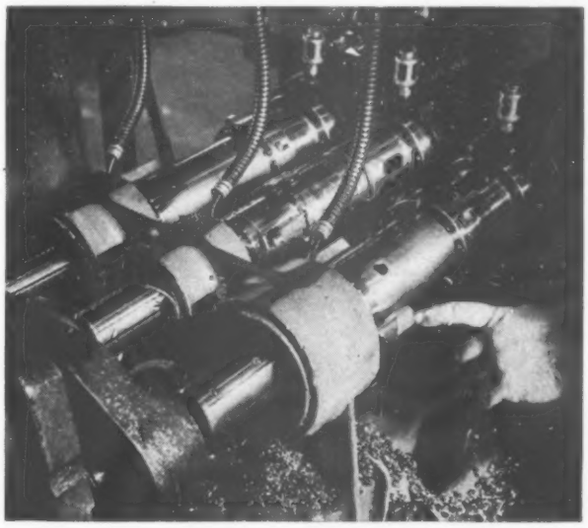


on the table from the same surfaces by which they were located on the layout table. Right- and left-hand screws at each position on the planer table center the cradle units in the same position for each load. By standardizing the planer set-up for this operation, considerable time is saved in getting each load aligned for gang planing end surfaces which are used for locating the cradles in subsequent machining set-ups. A long-bed planer is used so that a large number of these cradles can be planed at one time.

A gang-planing operation also is used for rough and finish machining the guide ways on the cradles. For this operation the cradles are placed in fixtures permanently mounted on the planer table, the cradles being set lengthwise on the table in two parallel rows so that both planer heads can be used. Heavy-duty fixtures are used on the planer table to insure accuracy of location of the cradles.

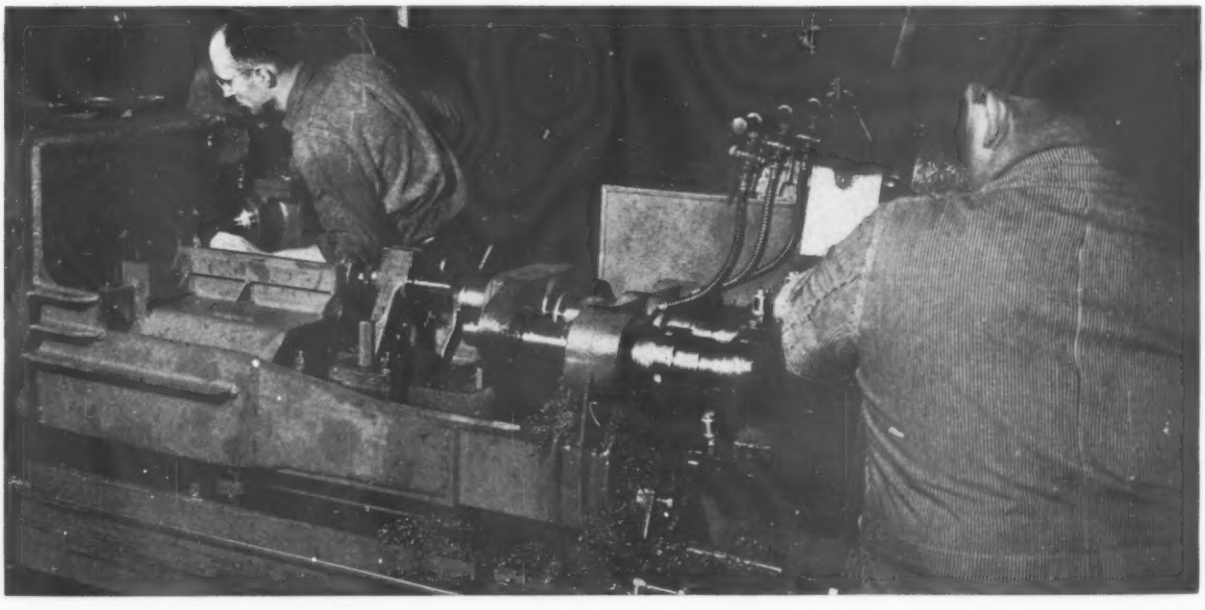
Because of the construction of these cradles, heavy cutting pressures tend to distort them. Therefore, light cuts are taken, with roughing being done at about 60 ft. per min. and with finishing cuts being taken at 70 to 75 ft. per min. High-speed steel bits are used, and setting plates are provided at the forward end of the table for rapid setting of the tools to position. Most of the planed surfaces are held within plus or minus 0.002 in.

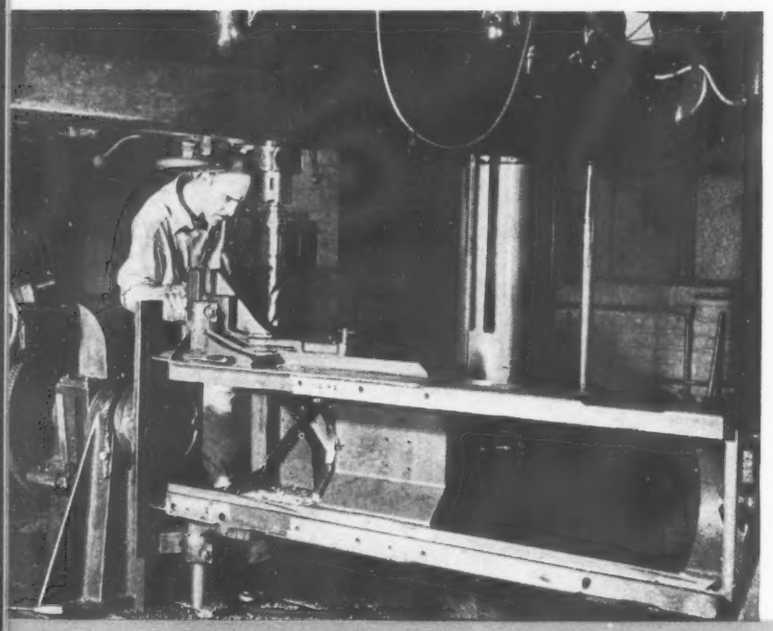
For planing the ways in opposite sides of the cradle units special clapper-box heads carrying two tools have been developed. The two small clapper boxes on each head can be swiveled for convenient planing of top, bottom and side surfaces on each channel. For planing oil grooves in the bottom surface of each of these channels, a special toolhead has been developed which is guided by a cam bar that



This close-up view of the three spindles in one of the heads on an Otis boring machine shows the roughing and finishing cutters employed. The roughing cutters consist of Kennametal-tipped bits mounted in Kelly blades set in the boring bars. Heavy cuts are taken when roughing, which is done at 140 to 160 ft. per min. Coolant is flooded over the bars during both roughing and finishing cuts

Special Otis double-head boring machines rough and finish six holes in each cradle. Heads are fed by hand, and two operators are employed to keep each machine producing at a maximum. The holes must be finished within plus or minus 0.0005 in. The part is lined up automatically when placed on the fixture





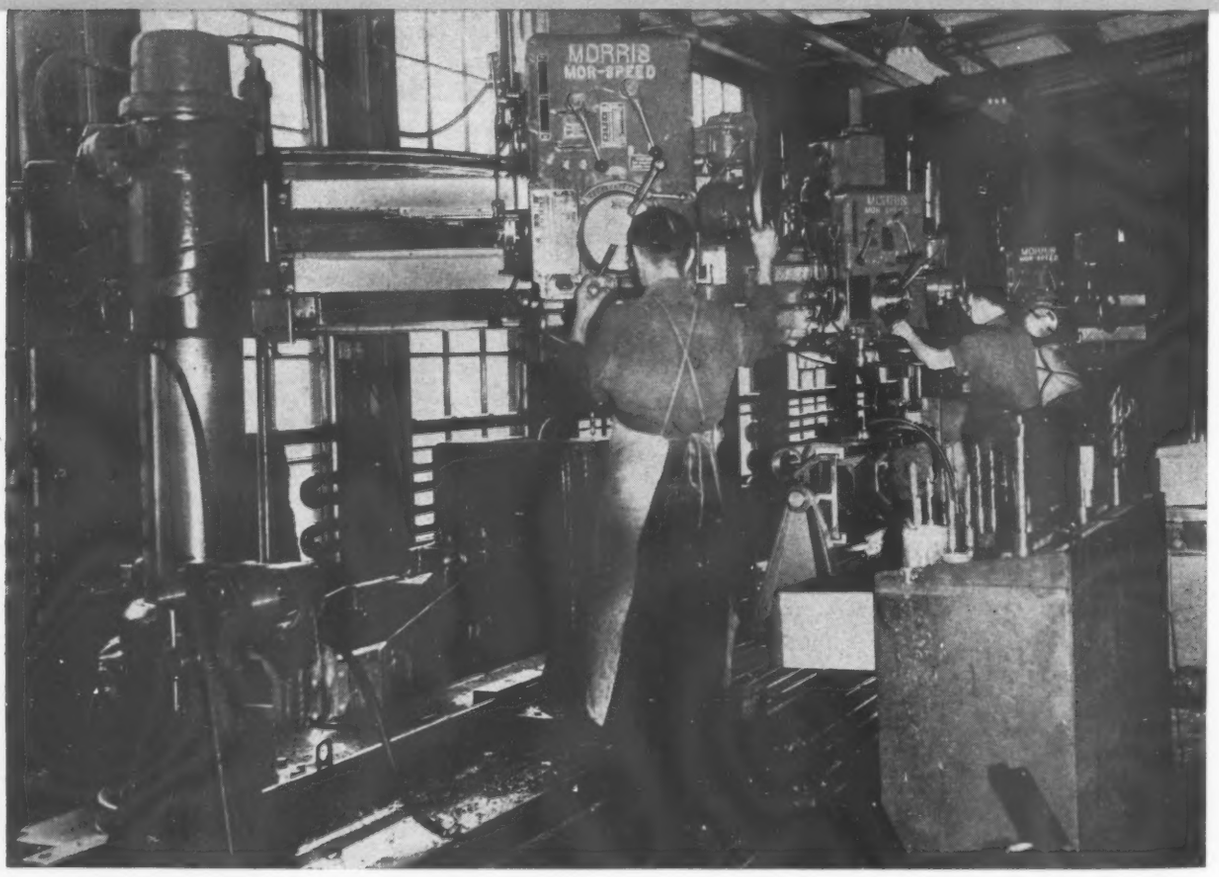
Original plans called for drilling, reaming and tapping all holes in the cradles in one set-up at a radial drill press. This meant providing a trunnion-type fixture, cutting tools and jig plates for the complete job at each machine, but was entirely satisfactory when production rates were low

is positioned on pads in the center of each of the locating fixtures on the planer table. This cam bar is removed when other operations are being performed on the same machine.

Center-section strips in each cradle are face milled with a high-speed steel inserted tooth cutter on a 3½-in. bar Sellers horizontal mill. For this operation the work is flooded with coolant and only light cuts are taken to avoid chatter. For this set-up, the cradles are located from previously planed surfaces and only one cradle is machined at a time.

Several Ingersoll planer-type milling machines with special horizontal and vertical spindle heads are employed for milling other surfaces on the cradle unit. Light cuts are taken with low feeds because the light-section cradles have a tendency to vibrate during a milling cut and so cause chatter. Most of the surfaces milled in these machines must be held within

Time was saved and production increased by dividing up operations on cradles among a number of radial drills set in line beside rails carrying wheel-mounted trunnion fixtures. Now, each operator has only a small number of holes to drill and ream or tap; only one set of cutting tools and jig plates is necessary

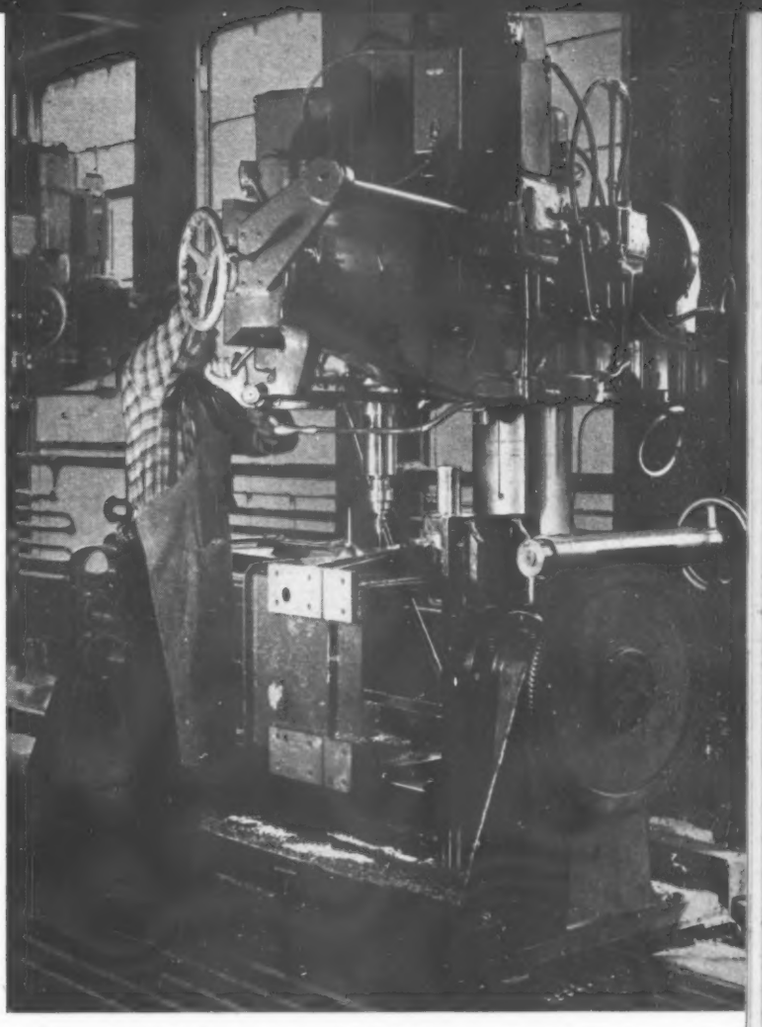


plus or minus 0.002 in. both for location and dimensional accuracy.

Boring trunnion holes and recoil cylinder locating holes in the cradle is done in the special two-way Otis boring machine, using Kennametal-tipped bits in Kelley cutter plates held in position in the various boring bars. Finishing these bored holes is done in the same set-up with high-speed steel bits carried in heads adjustably mounted on each bar. Four bits are mounted in each of these finishing heads. Six holes are finished at each set-up, the cutting speed being 140 to 160 ft. per min. Hand feed is used for each of the two boring heads, two operators being assigned to each machine so that longitudinal and transverse holes can be finished at the same time. Most of these holes must be held within plus or minus 0.0005 in. for dimensional accuracy and location.

Relatively heavy cuts are taken in the rough boring operation, in some cases from $\frac{3}{8}$ to $\frac{1}{2}$ in. stock is removed on the diameter. The fixtures employed on these machines are sufficiently rugged to stand these heavy cuts and still hold the piece accurately. They also are arranged to automatically line up the cradles against hardened stops when the cradles are lowered into position over the fixtures.

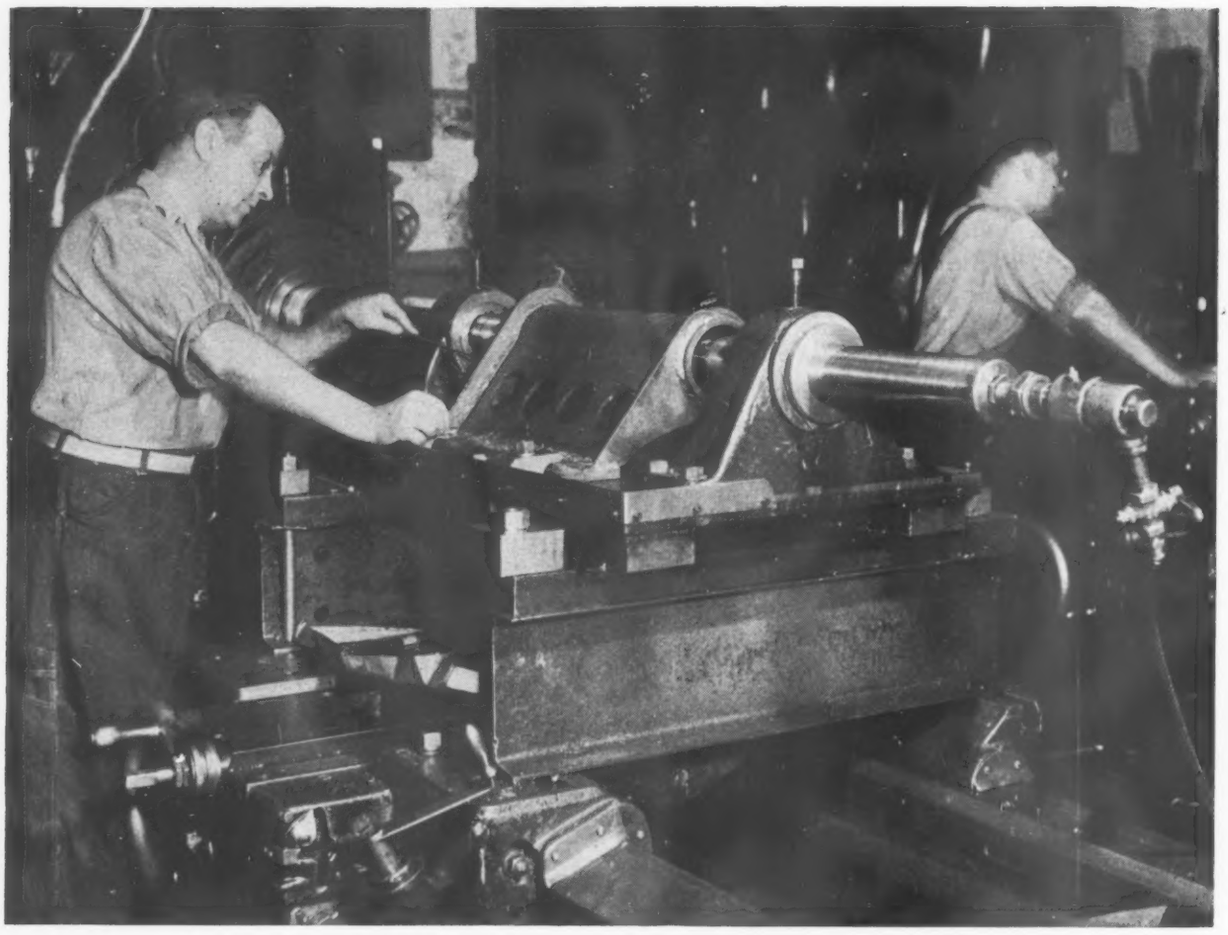
Quick-acting fixtures permanently mounted on the table of a 36-in. Bullard vertical turret lathe hold yoke forgings for recoil mechanisms while they are being bored and faced. High-speed steel bits are employed for these operations. Boring is done at 30 ft. per min. with a 0.018 in. per rev. feed when finishing



Steel rails laid along the radial drill press line for cradles carry the trunnion-type fixtures from machine to machine. The fixture carriages are locked in position at each work station except when being moved

A large number of holes must be drilled, reamed and tapped in all four sides of each cradle. Trunnion fixtures have been developed to position the cradles under a radial drill press for these operations. In the original operation line-up for the cradles, all of the drilling on a cradle was done at one machine, and the trunnion fixture was permanently fixed to the base of the radial drill. This was entirely satisfactory so long as the production rate was relatively low, but now that requirements have increased higher production must be expected from each machine. Furthermore, the addition of new radial drills was necessary to take care of the extra work involved. The problem of securing the necessary drills, taps, counterbores and reamers for each set-up was found to be difficult.

A survey was made of all drilling requirements



Lacking a precision boring machine for finishing welded buffer housings, this 60 in. Niles lathe was converted for the job by building up a work-holding fixture on the carriage and providing guide bushings for the boring bar at each end of the fixture. Cutting oil is fed under 5 lb. per sq. in. pressure through the bar to a point just ahead of the high-speed steel bit. The 4¼-in. diameter hole is bored at 26 r.p.m. with a 0.028 in. feed

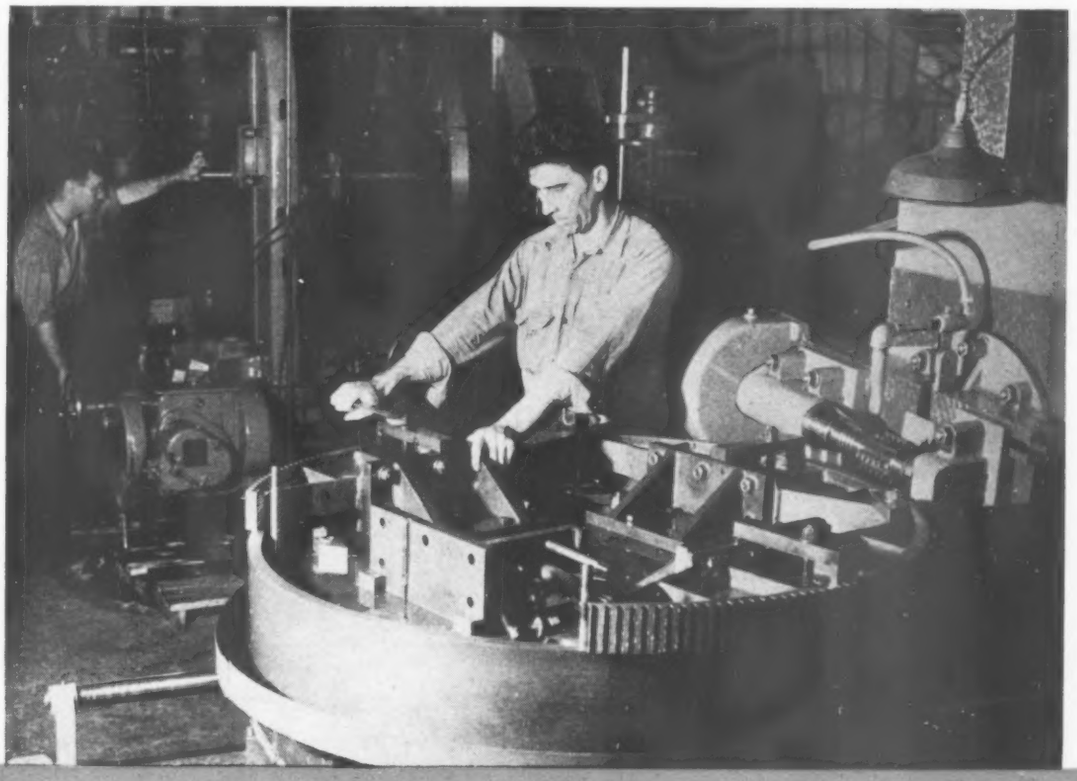
and it was decided to assign to other operations all of the radial drills previously used for drilling cradles and to set up a progressive drilling line for these parts, using new machines. A number of 4-ft. arm Morris radials was purchased for the cradle department. These were installed in a straight line down one of the bays in such a way as to permit moving the work from one machine to the next as the subdivided operations are completed.

Trunnion-type fixtures still are used for drilling the cradles in the new radial drill press line. The cradles are mounted between end plates fitted with trunnion bearings, and the fixtures themselves are mounted on special wheeled trucks that are moved from machine to machine along rails bolted to the shop floor. Each truck is equipped with a clamping device to hold it in position at each machine.

By dividing up the radial drilling operations on the cradles a number of advantages have been obtained. First of all, only one complete set of drills, reamers, counterbores and taps is needed for the line, whereas a set of tools would be necessary for each machine under the old set-up. In addition, only one set of drill jig plates is required. The saving in the amount of tool steel required to make the tools for this line has been considerable. A tool bench has been provided at each radial drill press in the line to provide storage space for the various tools required at that position. The work at each station has been balanced in so far as possible so that each operator completes his job at about the same time and it is possible to move the cradle fixtures from machine to machine without too much waiting on the part of any operator. Furthermore, the most competent operators have been assigned to the operations that require the most care, while the rest of the operations are performed by less skilled men.

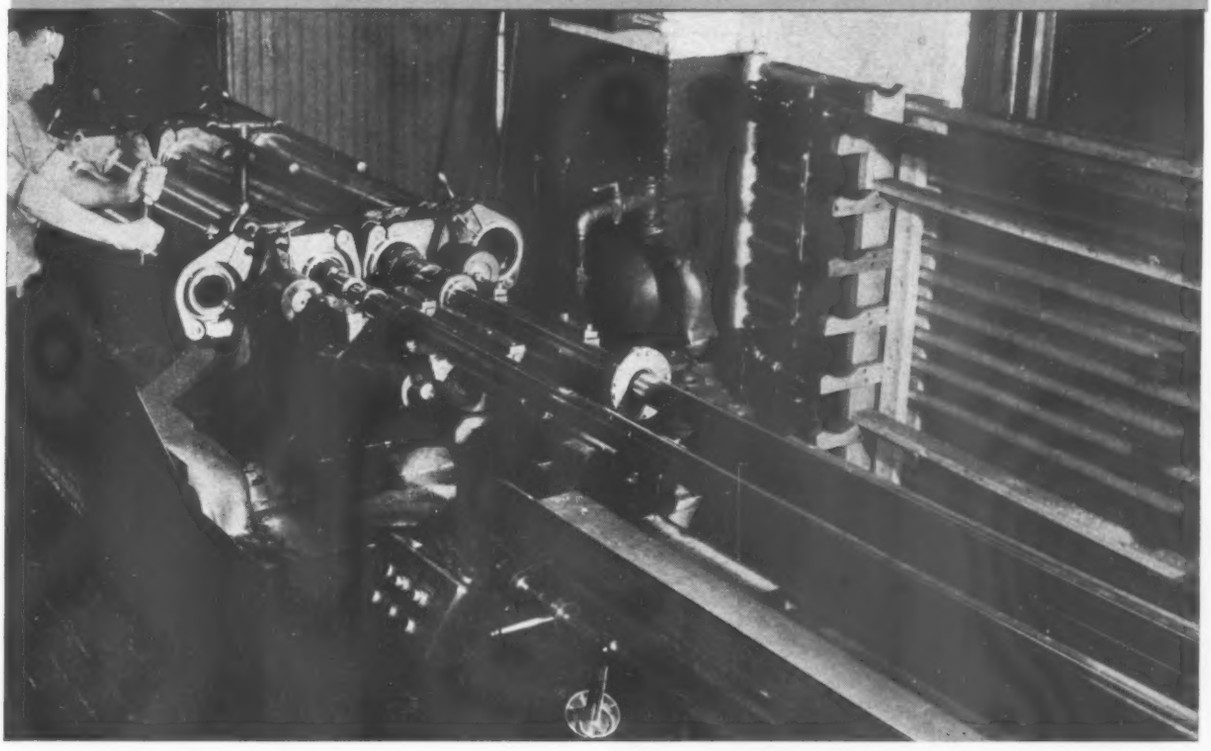
At the end of the line, the finished cradle is removed from the fixture and the fixture then is run on to a special cart with caster wheels. This cart then is moved to the head end of the line by a power truck and a new cradle is positioned for drilling.

A considerable number of miscellaneous machining operations are required to finish the smaller elements which go to make up the final recoil mechanism assembly. Much of this work is done in Bullard vertical



Welded elevating gear sectors for recoil mechanisms are roughed in Newark gear cutters and then finish hobbed in Gould & Eberhardt machines equipped with special table fixtures

Duplex Barnesdril honers are used for finishing the bores of recoil mechanism cylinders. Two-position fixtures are mounted on the bed of this machine for each honing spindle, so that a tube can be clamped in position while another tube is being honed

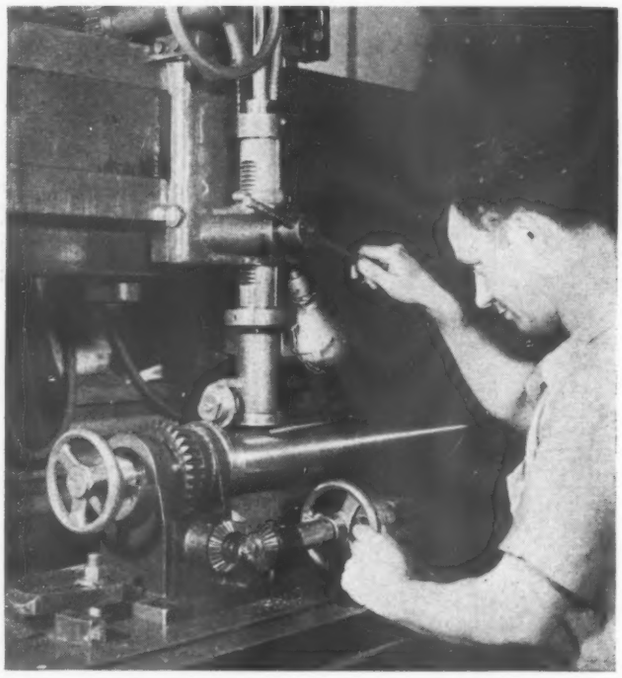


turret lathes, with the parts being located in welded fixtures mounted on the table of the machine.

Elevating gear sectors are cut four at a time. They are rough cut on a Newark gear cutting machine and then finish hobbed on a Gould & Eberhardt hobber on which the work-holding table has been equipped with special fixtures to properly position the work pieces. The mounting surfaces of the gear sectors are scraped to a master before mounting on the fixture so as to assure an accurate fit.

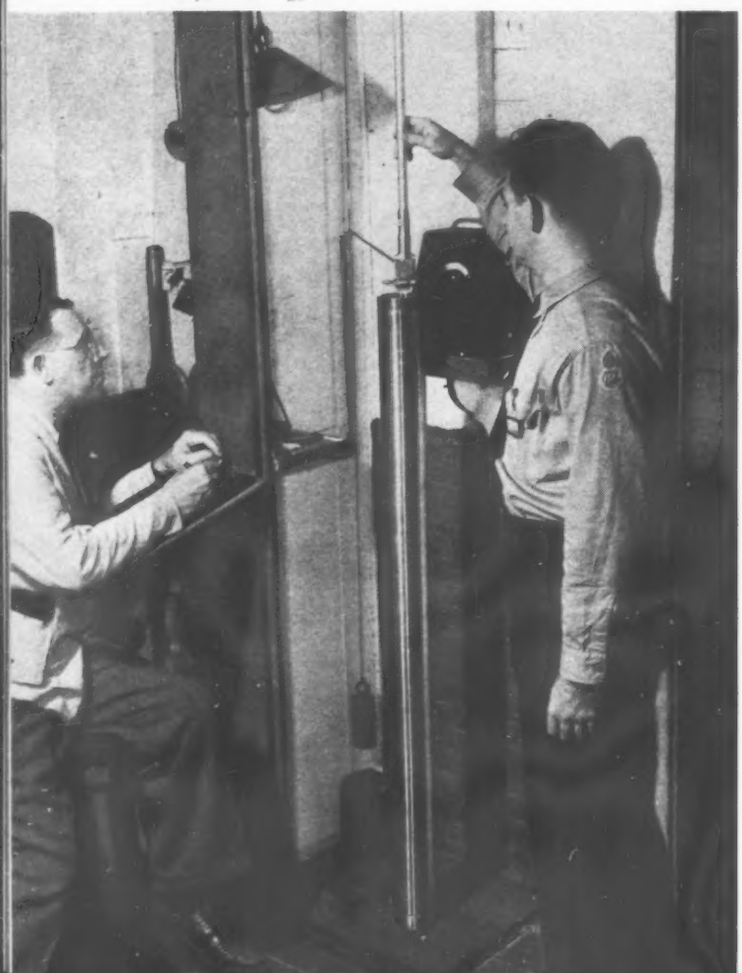
The recoil cylinders are precision bored and then finish honed in large Barnesdril honing machines equipped with duplex fixtures to reduce time usually lost in changing set-up. The operator of the machine unloads and loads cylinders in the fixtures while the two honing heads are at work in cylinders in the opposite positions.

An interesting special machine has been built in our shop for backing off the start of the threads cut in the ends of each recoil cylinder. Essentially, this machine consists of a rail-type drill on which the two remaining spindles have been equipped with right-angle drives to carry milling cutters. In operation, one cutter is used at a time, and the work is rotated against the cutter until the necessary stock has been removed. This machine eliminates the usual hand "chipping" and filing operations ordinarily necessary in cleaning up thread ends on such parts. The fixture on the table of this machine is equipped with adapters for the various diameter cylinders being manufactured. A $2\frac{3}{4}$ in. diameter screw slotting cutter is used in each head.

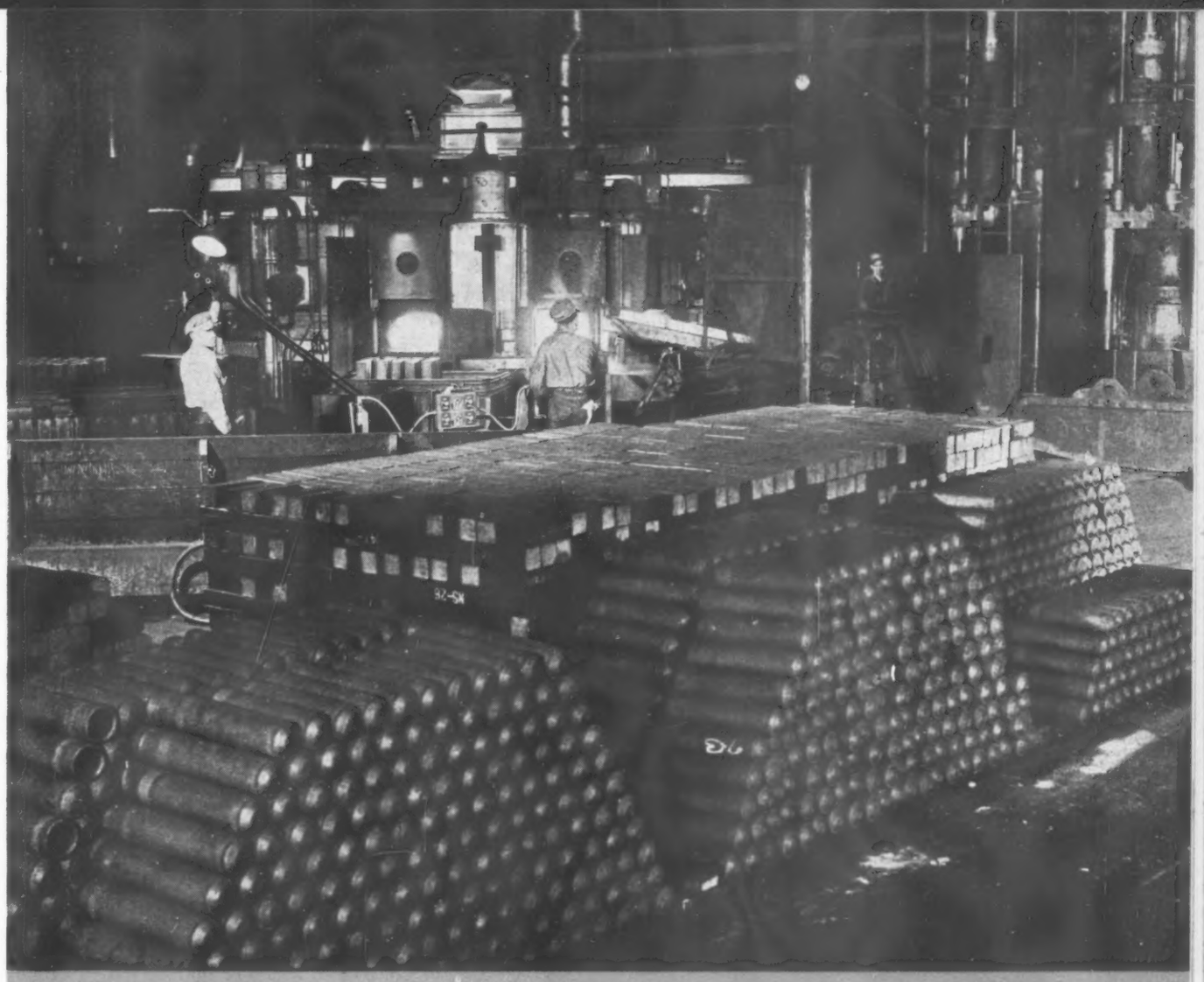


Hand chipping and filing operations are eliminated when squaring up the end threads on recoil cylinders by using the fixture and right-angle head drive for the milling cutter shown in this view

Before delivery to the final assembly department all units that go into the recoil mechanism assembly pass through a final shop inspection and an Ordnance Department inspection group. Standard and special gages are employed to speed up these inspection operations. One of these is a star-type Electrolimit gage for checking the bores of recoil cylinders. For ease of operation, this gage is suspended by cable from a pulley in the ceiling, and the cylinder to be checked is set vertically under the gaging head. The head is pushed down into the cylinder slowly and readings are taken at the end of each inch of traverse through the cylinder. When the first set of readings has been completed, the gage is withdrawn and the cylinder is turned 90 deg. Then the gage is reinserted for a second set of readings.



Ceiling suspension for the Electrolimit star gage used for checking the bores of recoil mechanism cylinders saves much time. The bores of these cylinders must be within 0.0005 in. for roundness and must not vary in diameter more than 0.001 in. over the full length of the cylinder. Diameters are checked for each inch the gage is lowered into the cylinder, then the gage is withdrawn and the cylinder is turned 90 deg. and another set of readings are taken



In one plant forging 105-mm. high-explosive shell, a forging unit consists of a gas-fired rotary furnace, two hydraulic piercing presses and a hydraulic draw bench. Heated billets are pushed through a descaler

NOTES ON SHELL FORGING

By J. B. NEALEY
Office of the Chief of Ordnance

While there are a number of processes by which high-explosive shell are forged, the two principal ones are the pierce-and-draw method and the upsetter method. Shell production today is probably divided as follows: pierce-and-draw, 55 percent, and upsetter, 40 percent, with the remaining 5 percent divided among the other processes, most prominent of which are bulldozing and the Assel cross-roll mill. It it were possible to develop a trend at this time, it would probably go in the direction of the upsetter for the reason that this type of shell forger can be converted to many other kinds of product after the war while the other methods are more specialized.

While the pierce-and-draw method varies materially from the upsetter method in plant installation and operation, comparatively speaking there is little choice between the two. Of course, crew ability and management vary as between plants, and quite a story could be built up around either method by stressing those plants with exceptional records. At the same time, many advantages and disadvantages could be listed for both, but in perspective these will mostly cancel out. For instance, while some plants will run along with rejects down to 1 percent, others will run

much higher, but the average for both methods is about the same—5 percent.

All sizes of shell are forged by the pierce-and-draw method, while the upsetter is limited to the smaller sizes—up to and including 3-in. and 105-mm. shell. The limit so far reached for the upsetter is an installation for producing 155-mm. shell. Forging shell of any larger size by this method is still considered impracticable.

Advantages and Disadvantages

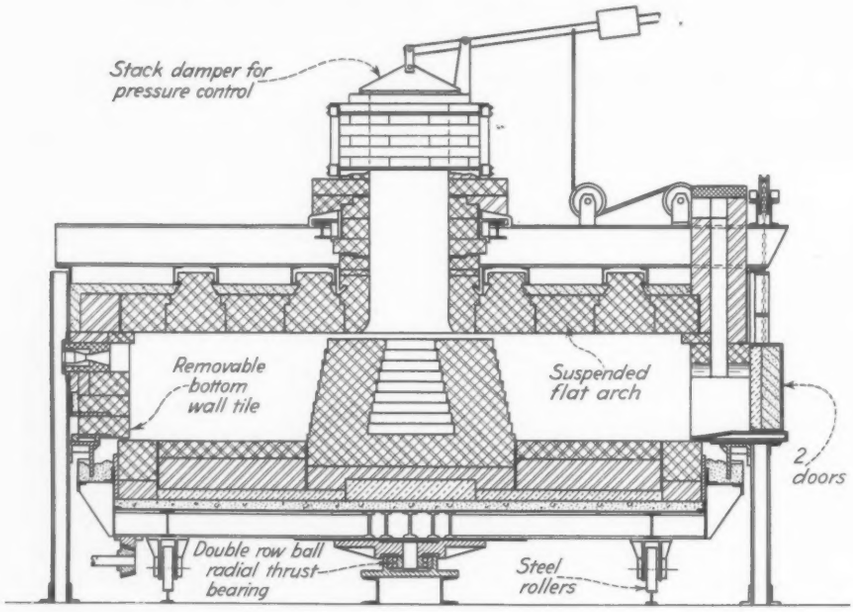
One argument in favor of the upsetter is its ability to shape the outside of the shell. This saves considerable metal (20 percent in some instances), and naturally reduces machining. On the other hand the upsetter requires a more thoroughly trained staff, as maintenance here is much more exacting. Die design and die sinking is a fine art that is brought to a high degree of perfection in using this method. Volumetric displacement of metal must be carefully worked out. The difference in volumetric displacement from die to die (usually five) must always equal the punch displacement. If this balance is upset, either through improper design or unequal wear, serious consequences follow.

Other limiting factors are tool temperature and tool life. The work performed by the upsetter is divided among five or six tools, which reduces the work and wear of each. However, the cavities of the shell are more liable to scratching in this method. While tool life in the pierce-and-draw method is quite short, the punches and dies are easily and cheaply made. One difficulty sometimes encountered in the pierce-and-draw method is the maintenance of a uniform thickness. If the metal is too hot the base may thin excessively. Also, eccentricity may occur. These defects, once corrected in an installation, seldom recur.

As already stated, production rates vary materially from plant to plant regardless of the method employed. Probably a fair comparison would be as follows: two presses and one draw bench will turn out 175 shell of the 105-mm. size per hour, as against an output of two upsetters amounting to 160 per hour. The pierce-and-draw set-up will require, roughly, a crew of 13 men, plus labor on supplemental equipment such as pumps and accumulators. The upsetters can be operated by five men each, or ten for both. A single Assel cross-roll mill has been reported to be turning out 300 75-mm. shell per hour.

Shell steel of WD-X1335, WD-X1340, and WD-X1345 is used; this comes in 16-ft. bars, 4-in. square, for the 105-mm. shell. In one plant making this size of shell, roller conveyors are employed for easy handling of the bars from one operation to another. A cutting torch rides on a guide just above the first of these conveyors and cuts the billets into 22-in. lengths. These are nicked at the center with another torch and broken in two in a 125-ton hydraulic press. Nicking should never be more than $\frac{1}{8}$-in. deep. This affords a fractured surface on the two forging billets to permit visual inspection for piping or other defects. As the billet is forged, this end becomes the base and a perforation might result in the high-explosive charge bursting with the propelling charge in the gun, killing the crew.

This fracturing is a ticklish job, as more billets are rejected for "bad breaks" than for steel defects. The fractures should be fairly square and smooth, without tearing or cracking, or defects will develop



The gas-fired, rotary-hearth furnaces used for heating shell billets have a suspended flat arch roof and a circular refractory section in the center. The annular hearth is supported by rollers running on a circular rail and by a revolving post arrangement in the center which is supported by a ball thrust bearing. The hearth is 3 ft. above the floor and about 17 ft. in diameter

in the finished shell. Poor fracturing results from any one of several causes while the steel is being made and rolled. The steel mills have recognized this, and are taking every precaution. A coarse-grain structure is one requirement. It is reported that billets from some heats fracture better under a board drop hammer or steam hammer than they do under an hydraulic press. The fractured billets are inspected 100 percent for cracks, pipes, inclusions and segregations.

There are a number of shell forging units in the plant mentioned above. Each of these units includes a furnace, two piercing presses, one drawbench, and a cooling device. The furnace is of the rotary-hearth, gas-fired type and is designed to heat over 4,000 105-mm. shell billets to 2,240 F. every 24 hours. One of these furnaces has furnished hot steel for forging as many as 1,798 shell in a single eight-hour shift, a forging rate as high as four per minute being attained at times. Gas consumption per pound of steel heated averages close to 1,500 Btu.

The furnace is of steel and refractory construction, with a suspended flat arch roof and a circular refractory section in the center. The hearth is in the form of an annular ring, 17-ft. in diameter, but is only $6\frac{1}{4}$ ft. wide. The hearth sets on an annular steel ring supported by rollers riding on a circular rail, and in the center by a revolving post construction with a double-row ball radial thrust bearing. It is rotated by a direct ring gear and pinion hearth drive. Heat is supplied by ten burners attached to two manifolds to provide two-zone heat control. The heats in these zones, bringing-up and soaking, are regulated by automatic temperature controls with recording pyrometers. Air is supplied by a blower and proportioning of the air and gas flow to the burner is also controlled mechanically.

Automatic Furnace Feed

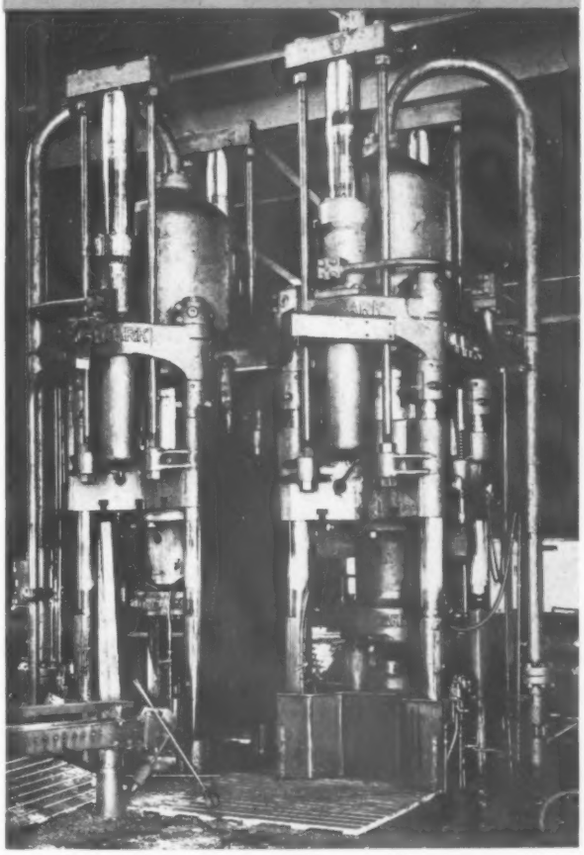
The furnace is loaded and unloaded in two operations through two 16-in. doors placed side by side. Each door is provided with 12-ft. long tongs suspended from chains. The intermittent movement of the furnace hearth is automatically controlled, so that each billet makes a complete turn in the furnace in approximately 70 min. Uniformity in spacing the billets on the hearth is important in order that they may all have the same temperature for the presses. Experience in this plant indicates that a fairly heavy scale is more easily removed than a light scale and the furnace atmosphere is adjusted to produce the former.

On removal from the furnace, the hot billets are placed on a roller conveyor that carries them to descaling rolls, where an hydraulic ram pushes them through the rolls and then through a high-pressure water spray. This thoroughly cleans them.

The billet is pierced to form a shell forging at a single stroke of the hydraulic press. When the billet is placed on the bottom platen, an enveloping pot die descends to form the exterior and at the same time forces the hot billet down against a stationary punch or piercing mandrel to form the cavity. The forging sticks in the upper die, and on the return stroke is ejected by a knockout bar and pin. A centering boss on the base of the forging is formed by a cavity in the end of the knockout pin. The square billet in the cylindrical die induces lateral flow of the hot metal in piercing. Basically, this is the Ehrhardt piercing process. The down stroke of the press, when piercing 105-mm. shell, is accomplished in about 4 sec. Pot and punch are cooled after each cycle by a water-and-oil solution sprayed automatically.

The forged shell are lengthened and narrowed by pushing them successively through three annular ring-type dies on an hydraulically-operated push

Hydraulic presses are used for piercing the hot shell billets prior to drawing. The billet is placed by hand in a cup on the bottom platen and an enveloping die pot descends to form the exterior and force the billet down against the stationary punch to form the cavity



bench. A punch is inserted in the forging to preserve the cavity size, as this is forged to such tolerances as to preclude the necessity for machining. As the three dies are progressively smaller in diameter, the wall of the forging is somewhat thinned. The inside diameter of the last die determines the size of the shell.

Quenching of these high-sulphur, air-hardening steels is accomplished with an air blast. The shell are placed in holes cut in a 16-in. pipe, some 30-ft. long, into which a blast of air is forced by blowers. Everything else being correct, this brings the physical characteristics up to Ordnance specifications of 105,000 lb. per sq.in. tensile strength, with a yield point of 70,000 lb. per sq.in., an elongation of 16 percent, and a reduction of area of over 45 percent.

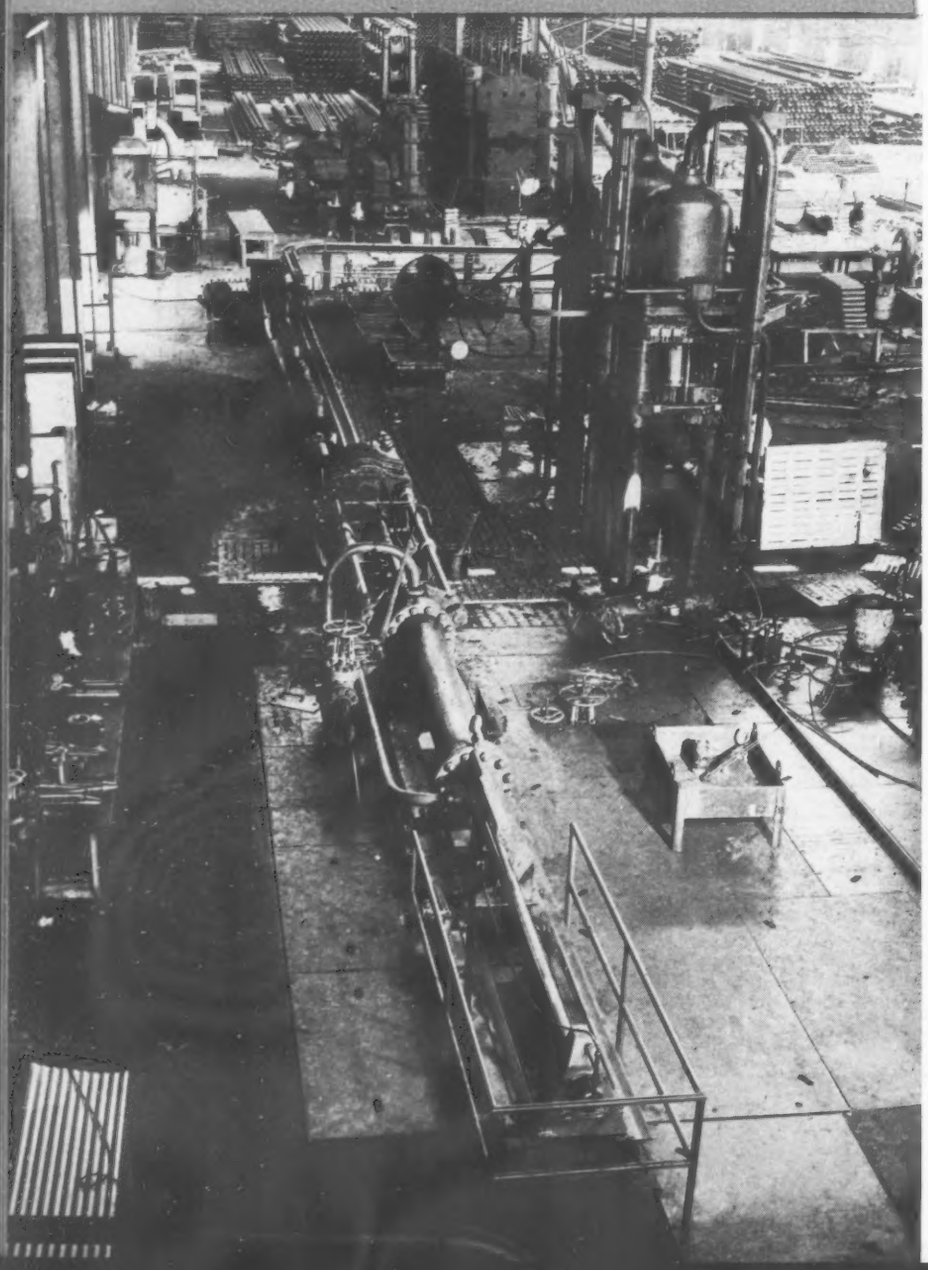
Placed in tote boxes, the cooled shell are moved by overhead cranes to inspection benches. Inspection is most rigorous and 100 percent by both the manufacturer and the Ordnance Department of the U. S. Army. All shell with enough scale inside to hinder inspection are shotblasted. First the shell are placed on a rotating mandrel with dial gages and checked for concentricity. Two long parallel steel tables are used to roll the shell along during inspection, the first table is for factory inspectors and the second is for Ordnance inspectors.

All dimensions are carefully gaged and the shell are then visually inspected for such defects as cracks, pits, scores, seams and flash. Any one of these defects may be cause for rejection by the Ordnance inspector, although some repairing is allowed. Scores and pits on the inside must not be deeper than 0.0125 in. for 105-mm. forgings, and scores must not have sharp edges. Shotblasting is permitted to clean up shallow pits and grinding is used to smooth scored surfaces. Seams and cracks are not allowed.

Handling is rapid and efficient. The inspected shell are rolled from the inspection benches into buckets, which are picked up by lift trucks. An indoor railroad siding runs along one side of the building, with sufficient length to spot ten freight cars at a time.

High-sulphur, air-hardening steels for making shell (trench mortar shell excepted) will shortly be abandoned in favor of straight carbon steels. There are several reasons for this; prominent among them is the fact that due to the immense quantity of scrap returned from shell plants an inordinately large amount of the country's steel production is fast acquiring an unwanted build-up of sulphur. Another reason is that a smaller crop is taken from straight carbon steel billets than from those high in sulphur, and this results in a higher rate of output at the steel mills. Also, there will be a saving in manganese. Finally, less time is required for chipping, grinding and otherwise preparing straight carbon steel billets for rolling as against those of a high sulphur analysis.

Pierced billets are drawn in a horizontal hydraulic draw bench having three solid ring dies. Finished forgings are dropped onto a roller conveyor and then lifted by tongs into a cooling device which assures uniform physical characteristics



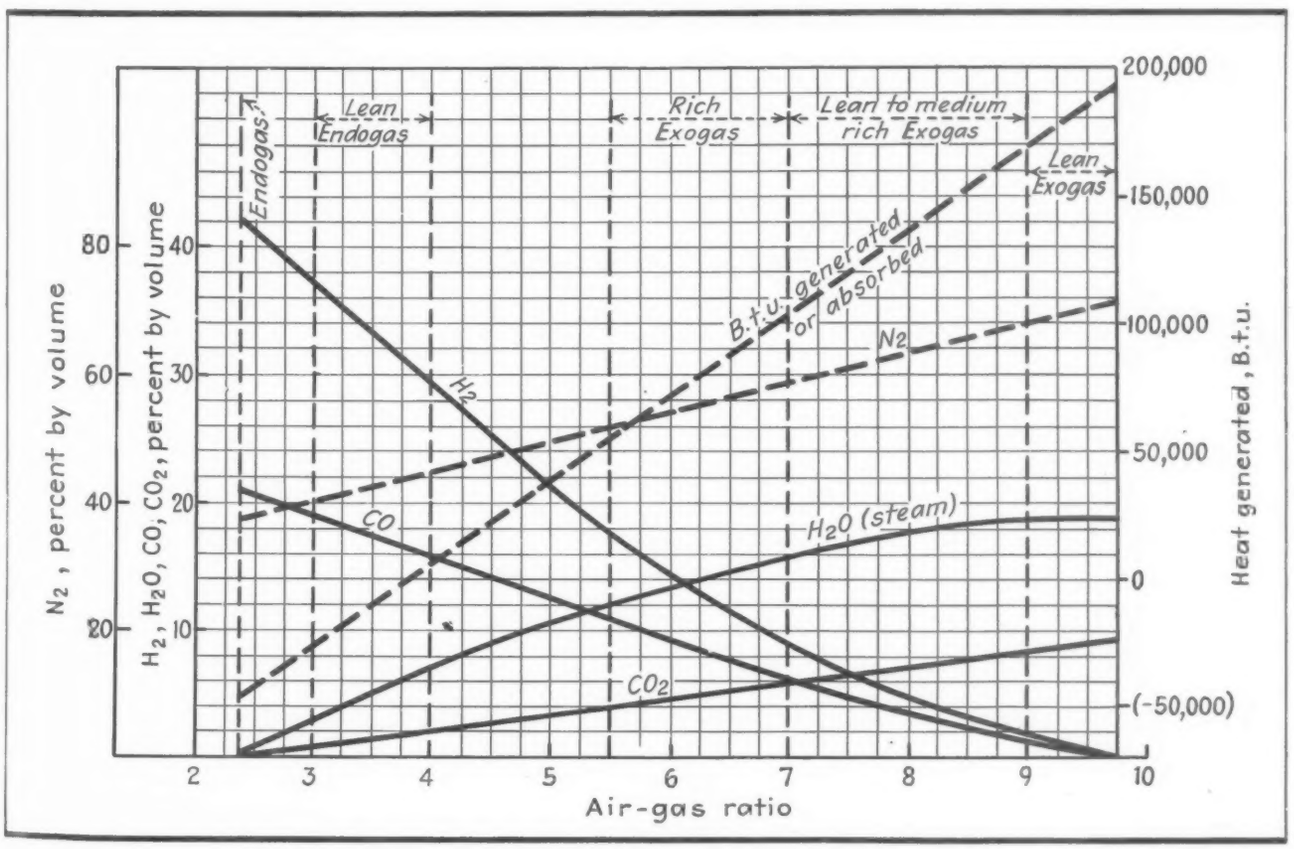
Controlled Heat-Treating Atmospheres—III

BY C. E. PECK, HEATING ENGINEER, WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY

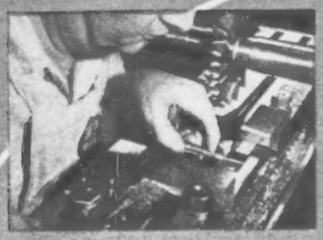
Combustion charts are useful in defining the principal commercial types of heat-treating atmospheres produced from any fuel gas or combination of fuel gases. Types of such atmospheres, the type of equipment needed to produce them, and the application of each to various heat-treating processes have already been published (*AM*—Vol. 86, pages 1315 and 1317).

The combustion chart will show what happens when a fuel gas is burned with various ratios of air-gas mixtures over the range for complete combustion to complete cracking; heat is generated in the combustion range, while heat is required in the cracking range to complete the reactions. Such charts are ideal in character; for example, in the one shown here for methane, traces of methane which are present in the partial combustion and in the cracking range are neglected.

The amounts of the various constituents shown at any given ratio represent values which can be approximately obtained with well-designed commercial gas-generating equipment operating at the proper capacity and temperature and with sufficient heat and catalytic surfaces to promote chemical reactions rapidly in such a direction as to increase CO and H_2 gradually as the air-gas ratio is reduced, and at the same time gradually decrease the amounts of CO_2 and H_2O produced in corresponding proportions. In actual practice the H_2O present in the gas corresponds to approximate room-temperature saturation (3 percent by volume at 75 F.) since the excess water vapor produced by the chemical reactions is condensed out by cooling the gases to room temperature. Note that the extreme right-hand side of the chart corresponds to theoretical complete combustion where the products are CO_2, H_2O and N_2 from the air. Also note that the extreme left-hand side of the chart corresponds to theoretical complete cracking where the products are CO, H_2 and N_2 from the air. Between these two limits there is a gradual change from maximum CO_2 and H_2O at complete combustion to zero CO_2 and H_2O at complete cracking. Similarly there is a maximum of CO and H_2 at complete cracking, which gradually reduces to zero CO and H_2 at complete combustion.



This chart shows combustion properties of methane from complete combustion to complete cracking. Such a chart can be prepared for any fuel gas or combination of fuel gases. They are useful in determining the principal commercial types of atmospheres produced from a fuel gas



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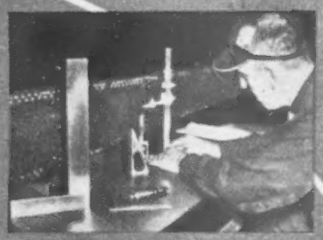
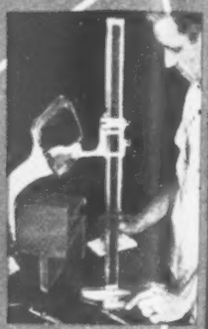


VULTEE

NORTH AMERICAN

STARRETT TOOLS

DOUGLAS



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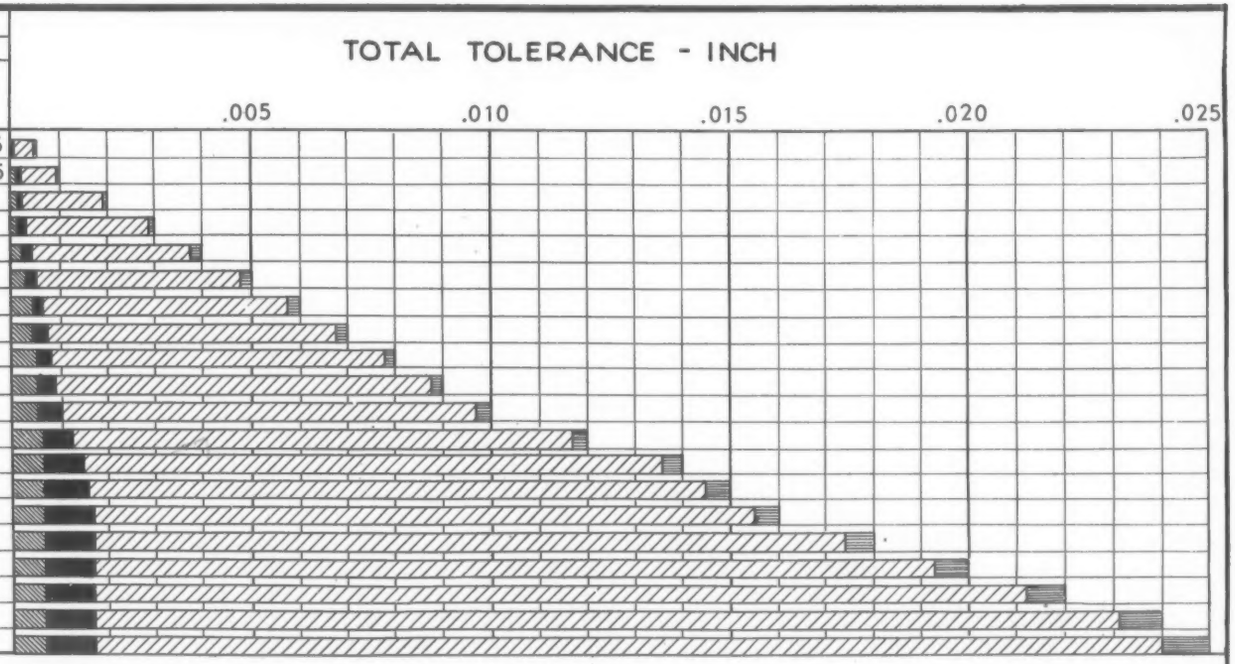
Wear Allowances and Gagemakers Tolerances

BY A. SPRUNG, PRODUCTION SERVICE DEPARTMENT, WAR PRODUCTION BOARD

Plain plug and plain ring inspection gages including plain ring gages for major diameter of screws and plain plug gages for minor diameter of nuts

COMPONENT	GAGE		
		TOLERANCE	
TOTAL TOLERANCE	WEAR ALLOWANCE	GO	NOT GO
.0005	.0000	.00005	.00005
.001	.0001	.0001	.00005
.002	.0001	.0001	.0001
.003	.0001	.0002	.0001
.004	.0002	.0002	.0002
.005	.0003	.0002	.0002
.006	.0004	.0002	.0002
.007	.0004	.0003	.0002
.008	.0005	.0003	.0002
.009	.0005	.0004	.0002
.010	.0005	.0005	.0003
.012	.0006	.0006	.0003
.014	.0006	.0008	.0004
.015	.0006	.0009	.0005
.016	.0006	.0010	.0005
.018	.0006	.0010	.0006
.020	.0006	.0010	.0007
.022	.0006	.0010	.0008
.024	.0006	.0010	.0009
.025 AND UP	.0006	.0010	.0010



Gagemakers Tolerance, Flush Pin and Adjustable Snap Gages

.0005		.00005	.00005
.001		.00005	.00005
.002		.0001	.0001
.003		.0001	.0001
.004		.0002	.0002
.010		.0003	.0003
.015		.0004	.0004
.020 AND UP		.0005	.0005

NOTE: The above chart shows the practice in plants of a United States Ordnance District on ordnance production for wear allowances and gagemaker's tolerances in the inspection of gages. For component tolerances not listed, the next smaller tolerance shall be used. The first four columns show numerical values, while the following portion of the table shows graphic values. Column 1 shows the total tolerance on the product. Column 2 the wear allowance on the "go" gage. Column 3 the tolerance on the "go" gage, and Column 4 the tolerance on the "not go" gage. There is no wear allowance on the "not go" gage because it wears toward the "go" gage and in the direction of safety.

Let us be thankful

* . . for our great and growing strength of arms.

. . . for the skill and will to see the fight through to a Victorious finish.

. . . for a Free America to fight for.

★

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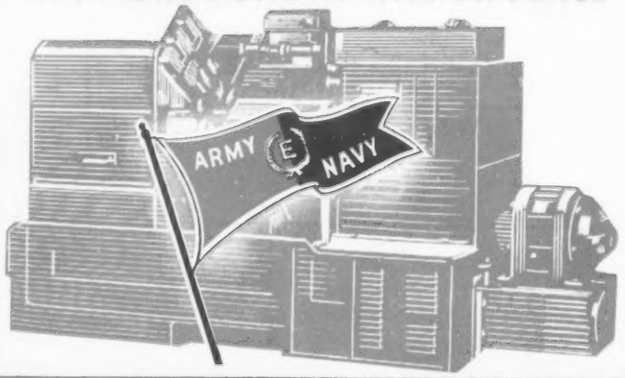
AUTOMATICS

GET MORE DONE IN WAR OR PEACE



And let each of us resolve to fi
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Are We at the Bottom of the Barrel?

"WE ARE BEGINNING to scrape the bottom of the barrel."

Washington officials make that comment at least several times a week.

It does not refer to flour or crackers or food at all. It does not refer to materials of any kind. It refers to manpower.

In a country as large as ours, that is a startling statement. Can it be true that out of a nation of 130 million people who have been at war less than a year, we already are exhausting our human resources?

Before we are ready to accept any such conclusion, we should like to ask a few questions about the use we are now making of our manpower.

Is there good reason for an increase of 100,000 a month in the number of federal civil service employees since Pearl Harbor?

Is it logical in wartime to expect that government employees—federal, state and local—should be larger in numbers than the total of men in our armed services?

Why is it that our war industries are encouraged to look for millions more of men when the present working force is operating an average of only about 43 hours a week?

Why is it that so-called "featherbed" rules, so widely applied by the railroad brotherhoods to "spread the work," are kept in wartime, thus tying up unreasonably large numbers of men to do a relatively small amount of work?

Why is it that in some establishments, according to reliable testimony by the management, the men producing war goods are told by union officials to turn out only a certain quota of work per day?

Why is it that so many companies have held back from employing women until pushed into a corner from which they could not escape?

What is being done to prevent the armed services from recruiting men from skilled jobs in war plants and from relying instead upon the Selective Service System, as advocated by General Hershey?

Is there any safeguard to prevent a graduate mechanical engineer, for example, from being assigned to a medical unit rather than to a task for which he is fitted by training and experience, at the time when he is inducted into military service?

We don't pretend to know the answers to all of these questions, or the answers to many other questions on the tip of our tongue. But we have the suspicion that we are continuing to waste manpower, which is our most precious national possession.

In the depression years of the thirties we became accustomed to "made work," to raking leaves, to doing a lot of things which created jobs on a basis apart from strict efficiency.

But we no longer can afford such luxuries. We must tighten our standards and do it speedily.

We Americans are boastful people. We think that we have the biggest and the best and the most of everything—materials, machine power, manpower. But even those assets begin to spread out thin in fighting a war which girds the globe.

If we will put to the best possible use the manpower of this country, eliminating practices which dissipate our strength and concentrating solely on the job to be done, we venture the opinion that we will soon discover that the contents of the barrel will go farther than many of us think.

Burnham Finney

GAGING BUSINESS

Aircraft manufacture, with change in designs, is given the lead in procurement of machine tools. For flexibility, machine tool industry thinks it should not convert to war goods production

Plane Makers Get Go Ahead The green light has been given to aircraft manufacturers in the procurement of machine tools for the new and expanded program for more air power. This action was revealed in the amendment of machine tool allocation order E-1-b in favor of aircraft requirements. The War Production Board has taken strong measures to remedy bottlenecks in aluminum shapes, propellers and other aircraft parts.

Airplane production faces serious problems, all of which should be solved within a short time. Emphasis is being shifted to heavy bombers. The United States is trying to slant its military aircraft output curve upward again, after a three-months' level period. A change is in process from initial war designs to new designs in all types, especially in bombers and fighters. All of this takes new tooling.

Some Confusion May Result It is realized in Washington that the rescheduling of machine tool deliveries to favor the aircraft industry will cause some confusion and trouble among machine tool builders, but that appears unavoidable. Under the new amendment, the air services are to be given preference over others in the military and naval group, seven in all, up to 75 percent of the production total of any machine tool.

This urgent call for machine tools by the armed forces, to be delivered as soon as possible and in any event before the end of the first half of 1943, underscores the fact that sudden and vital needs for machine tools are bound to arise as long as the war lasts. There will be shifts in emphasis from one type of weapon to another, and changing designs of these weapons will be developed. The result will be pressure for new tooling to be supplied by machine tool builders.

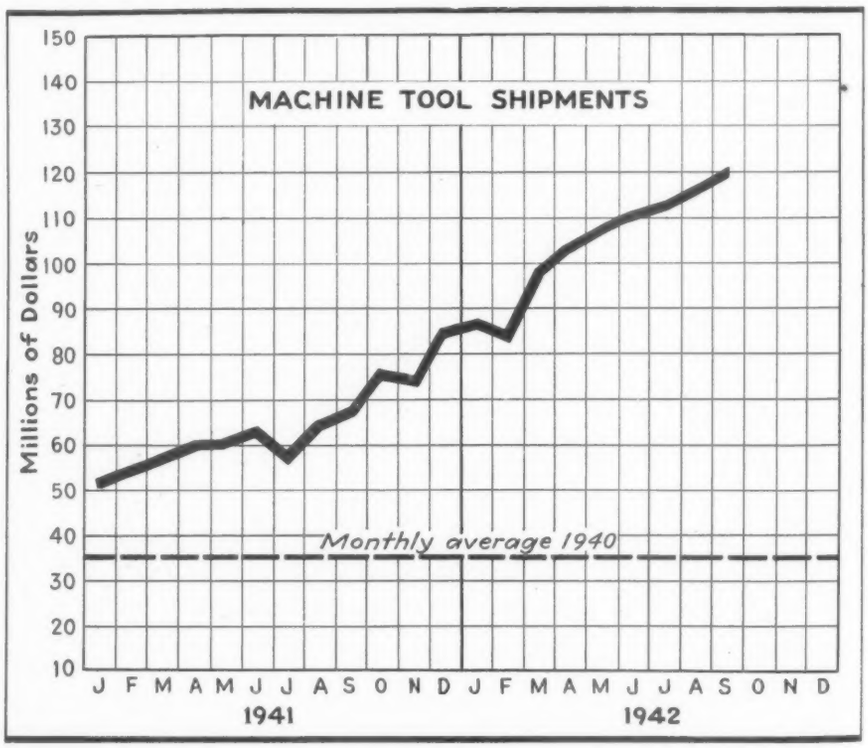
Tool Industry Must be Flexible The machine tool industry feels it would be a mistake to convert any of its facilities to production of war goods other than machine tools unless positive assurance is at hand that the portion of the capacity to be changed over will not be wanted again later for machine tool manufacture. If any machine tool plants should be used later on to make munitions, the decision would necessarily have to be arrived at on an individual plant basis rather than on an industry-wide basis.

Meanwhile machine tool companies still possess a backlog in excess of one billion dollars. If they are to perform the service now demanded of them by the aircraft manufacturers as well as by other war agencies, they must not lose essential men by enlistment or draft and they must be granted the small tonnage of materials necessary to keep going. Actual consumption of steel by the machine tool industry amounts to only 7/10 of 1 percent of the country's output.

Indispensable Orders, Only A definite drive is on in Washington to screen out all orders for new machine tools which are not indispensable to the war production program. This drive comes out of a desire to use materials only for essential purposes. It is agreed in government as well as industrial circles that thousands of machine tools around the country are idle all or a substantial portion of the time. For this reason it is believed wise to put every order for machine tools through a screening process. On that basis such agencies as the Ordnance Department of the Army already have cancelled a considerable number of machine tool commitments.

From now on, the machine tool industry expects that replacement orders for war work will be sizable. Tens of thousands of machines which are running 24 hours a day in war plants are wearing out two or three times as fast as normal. Many of these machines will have to be replaced. An important percentage of the machines going to England from this country are to take the place of worn-out machines.

Steel production has eased slightly, but still is of record proportions. Scrap drives have lessened the threat of a shortage.



Still Rising—September machine tool production totaled $120,118,000, as compared with $117,343,000 in August, a gain of 2.4 percent. Until recently, new machine tool orders have exceeded deliveries, causing a persistent increase of unfilled orders backlog. Production now is higher than new orders currently received, so that backlog is dwindling, and likely to continue. Trend in new orders has been downward since last spring

Newly Set-up CMP Already is Having Reorganization

Industry units are given division status, with greater responsibility for reestimating requirements, expanding resources and controlling the distribution of materials

BY ROBERT COLBORN

WASHINGTON—The Controlled Materials Plan is on its way to becoming the principal framework of WPB operations; that organization has been put through one of its periodic administrative re-shuffles. Effects of the change are two: To give WPB Vice-Chairman Ferdinand Eberstadt clear and direct authority over the work of the Director-General for Operations, Ernest Kanzler; and to strengthen the position of the industry branches, now dignified as divisions, which occupy key spots in the running of CMP.

Attached to the Office of the Program Vice-Chairman (Eberstadt) is the Requirements Committee which, made up of representatives of all the major war agencies, makes the final decisions on allocation of materials. Two staff units, the Program Bureau and the Facilities Bureau collect and prepare data and make preliminary decisions for the Requirements Committee. The rest of the OPVC comes under the Director General for Operations, with deputy directors in charge, respectively, of staff, industry divisions, and field operations. Of the industry divisions, formerly branches, two—Aircraft and Radio and Radar—report directly to Production Vice Chairman Charles Wilson and are attached only indirectly to the Eberstadt organization. Similarly the Rubber Division reports directly to Rubber Director Jeffers.

The three divisions dealing with materials controlled by CMP—steel, copper, and aluminum—work directly under Director Kanzler. The other divisions are grouped into four bureaus —a commodities bureau, a consumers goods bureau, a construction and utilities bureau, and an equipment bureau.

All of the divisions have been expanded by the addition of a labor advisory committee along with the present industry advisory committees and of a sub requirements bureau made up of representatives from the same war agencies represented on the big Requirements Committee.

Alongside these working units, are two staff agencies attached to Kanzler's office. One is a Resources Agency, similar to the former Conservation Division. The other is the Distribution Bureau headed by J. A. Krug and charged with responsibility for setting up and keeping running the machinery of CMP, PRP, and other priority systems. The Distribution Bureau is the tool room, as it were, of CMP, while the industry divisions are the production department.

Within the Distribution Bureau, specific responsibility for CMP is assigned to a CMP Division, headed by Harold Boeschenstein, president of Owens-Corning Fiberglas Corp. Its major job at present is that of educating industrialists on CMP and selling them on it. A series of seminars with manufacturers started this month. An elaborate book of some 125 colored charts explaining the workings of the plan is being prepared, as are a series of "primers" of CMP addressed to prime contractors, sub-contractors, etc.

CMP STAFF HEADS ANNOUNCED

WASHINGTON — Harold Boeschenstein, president and general manager of the Owens-Corning Fiberglas Corp., has been appointed director of the Controlled Materials Plan Division, WPB, and chairman of the CMP Board. Assistant director is W. C. Skuce, supervisor of materials procurement, priorities and inventory control for the General Electric Co. In distributing materials under the CMP, Mr. Boeschenstein and Mr. Skuce will work in close cooperation with Hiland G. Batcheller, Arthur H. Bunker and Harry O. King, directors of the three controlled materials divisions, steel, aluminum and copper.

Enactment of Manpower Laws Becomes Daily Less Likely

WASHINGTON—Prospects for action on manpower controls were growing, in mid-November, daily more remote. It's already obvious that there will be no early labor-draft legislation (*AM*—Nov. 12, p. 1318d). The President has before him recommendations from the labor-management advisory committee of the War Manpower Commission that he issue an executive order clarifying and extending WMC's powers. It's not even certain that this comparatively short step will be taken, since Army, Navy, and Selective Service oppose several of the recommendations.

Principal provisions of the proposed executive order would: (1) Make Selective Service clearly subordinate to WMC chairman McNutt; (2) Eliminate all voluntary enlistment into the armed services; and (3) Underline McNutt's power to order all hiring in labor shortage areas done through the U. S. Employment Service.

The advisory committee recommendation was rather reserved on this last point. Difficulty is that there is serious question whether USES is a strong enough organization to carry the load. The employment offices were originally state agencies and have been only incompletely federalized. For instance, they are subject to an agreement that salaries of USES employees will not be raised above state levels; this has produced a turnover in the organization of about 90% a year.

Meanwhile, one manpower development with which all employers should keep in close touch is the Manning Table method of handling draft deferments. After some months of experimentation, this system has been thrown open to all employers who are at least 75 percent on war work. Under the plan, an employer prepares an inventory of his people, showing their skills and how long it would take to train a replacement. On the basis of this a table of withdrawals of men into the Army can be prepared. These Manning Tables are submitted for approval, first to WMC then to Selective Service State directors. If it is approved, it is given an official number. Then, in submitting 42-A forms to local draft boards applying for occupational deferment of his men, the employer refers to his Manning Table number. This provides prima facie evidence as to whether and how long the man should be deferred. Within a few months, employers who don't using Manning Tables are likely to find that local draft boards accept this fact as evidence that he's not entitled to deferments. Employers wanting to get in on this, should write to the nearest office of the War Manpower Commission.

Single Head to Coordinate War Production Training

WASHINGTON—Because "practically all skilled workers are now employed," War Manpower Chairman Paul V. McNutt is coordinating all war production training divisions under W. W. Charters of Columbus, Ohio, an authority on technical education. McNutt says he will speed the program to fit for service in war production the millions of inexperienced men and women who will be needed from now on.

At the same time, Chairman McNutt said that the various war production training divisions will be expanded and closely coordinated.

Present plans call for the training of both old and young workers, as well as those of all races, nationalities and physically handicapped persons.

"E" Award Burgees Top More Flag Poles as War Plants Step-up Production Efficiency

WASHINGTON—Indications of excellency continue to rise to the tops of more and more flag poles throughout the country, as more and more industrial plants get into the swing of things and bring their production to a peak deserving award of the Army-Navy "E" or the Maritime Commission "M".

Last week awards were announced for the following companies:

Achushnet Process Co. Rubber Div., Aircraft Accessories Corp., Aluminum Co. of America (Niagara Falls), American Brass Co., American Optical Co., Atlantic Mfg. Co., Atwood Machine Co., Aviation Corp. Lycoming Div., Bakewell Mfg. Co., Bendix Aviation Corp. Eclipse-Pioneer Div., Benson Mfg. Co., Bliley Electric Co., Bound Brook Oil-Less Bearing Co., Buffalo Forge Co., Carolina Aluminum Co., Century Machine Co., Chromium Corp., Colt's Patent Fire Arms Mfg. Co. (Park St., Van Dyke Ave., Flower St. plants), Columbia Steel Co., Consolidated Aircraft Corp. (Plants 1 and 2).

Henry Disston & Son, E. I. du Pont de Nemours & Co. (Barksdale, Martinsville, Seaford plants), Edwards Co. Div. of Rogers Diesel & Aircraft Corp., Emerson Electric Co. (Booster and Turret Div. plants), Eureka Vacuum Cleaner Co. Gas Mask Div., Federal Products Corp., General Motors Corp. New Departure Div. (plants A and D), Gilfillan Bros., Inc., Grimes Mfg. Co., Haines Gauge Co., H. M. Harper Co., Heintz Mfg. Co., High Standard Mfg. Co., Ingersoll-Rand Co. (Painted Post plant), F. L. Jacobs Co. (Main plant), Lapp Insulator Co., Lemko Products, Inc., Lincoln Park Tool & Gage Co.

M. B. Mfg. Co., Meissner Mfg. Co., Middlesex Paper Tube Co., W. H. Nichols & Sons, Northern Engraving & Mfg. Co., Otis Elevator Co. Aeronautical Div., Peco Mfg. Co., Pittsburgh Forgings Co., Read & Lovett Mfg. Co., Sangamo Electric Co., Schauer Machine Co., J. M. Service Corp. (Kansas Ordnance plant), Singer Mfg. Co., Standard Gage Co., Inc., Summerill Tubing Co., Sunnen Products Co., E. H. Titchener & Co., Titeflex Metal Hose Co., Transue & Williams Forging Corp., United Specialties Co., United States Rubber Co. (Des Moines Ordnance plant), S. S. White Dental Mfg. Co., Wheeling Corrugating Co. (Wheeling plant), John Wood Mfg. Co., Zenith Radio Corp.

LaPointe Machine Tools Co.—received the Army-Navy "E" burgee in the presence of, above, l. to r., Judge David Dillon, Mass. Supreme Court, U. S. Senator D. I. Walsh, LaPointe Pres. J. J. Prindiville, Gov. L. Saltonstall, William Gibbons, employee representative and J. H. Prindiville, Jr., v. pres.

Leeds & Northrup Co.—heard Admiral H. A. Wiley, in presenting the burgee, say recommendations "could not have been higher." Above, Admiral Wiley, with Factory Manager W. R. Coley pause for a word with girl worker

South Bend Lathe Works — received its third production award recently. Formal presentation ceremonies were dispensed with to avoid disruption of production. Representatives of labor and management, above, hold the award

Independent Pneumatic Tool Co. —received the burgee among community-wide celebration, noonday church services and stamp sale drives. Right: Capt. Robt. Henderson, USN, N. C. Hurley, pres., and N. C. Hurley, Jr., v. pres., hold the award

INSIDE DETROIT

BY RUPERT LE GRAND

Army has a complete range of formidable assault vehicles in the works, with a number in production. The 1943 medium tank will have a standard engine and automatic transmission

1943 Material Highly Superior Until now the problem of the military authorities has been to place sufficient quantities of good equipment in the hands of combat troops. From here on the aim will be to provide front fighters with materiel that is not merely good, but ideal.

From what Lt. Col. J. M. Colby, chief of the development branch, Tank-Automotive Center, has to say on the subject, the American soldier, and our Allies too, will get equipment in 1943 that is far superior to current models. Just because we already have the best tanks in the world is no reason to sit still. The tank of next year will be much better, so will the tank destroyers, the armored cars, the gun carriers which the United States has evolved to fight a "horsepower war." Best of all, many of the new developments are already in production.

These modern behemoths of battle are not released for production until three major points are in nice balance: (1) firepower, (2) mobility and (3) armor. Just how do we stack up against the Germans in these matters? The Reich's Mark IV, or medium tank, in most instances is equipped with a 75-mm. howitzer that fires only H. E. shell: the American M4 has a high-velocity cannon that will fire both AP and HE, outranges the German gun considerably, and furthermore can be fought on the move because of a secret device that increases accuracy from 6 to 60 percent.

U. S. Tank Is More Mobile Prior to the advent of the American tank in desert warfare, the British and Germans were inclined to engage in long-range slugging matches, with the tanks often in a stationary "hulldown" position behind a hillock. But American tanks, in addition to more firepower and accurate gun sighting while moving, introduced a new factor—superior mobility. The Germans use a 250-hp. gasoline engine (not a diesel as popularly supposed) in their medium tanks, get a top speed of 18-20 miles per hour. Our M3 and M4 tanks have a 450-hp. engine, a five-speed precision-built transmission, adequate flotation on soil, sand or rock, and a top speed at least 50 percent greater than the enemy's equipment. In other words, our tanks can be fought in a wide variety of ways.

We intend to keep that extra measure of mobility. Two important decisions are in the making: (1) standardization of power plant, and (2) selection and standardization of an infinitely variable-speed transmission to replace the manually shifted type now employed. These decisions involve such a large measure of production on a standard item that both the engine and the transmission will probably be made as an "industry" proposition rather than by a single manufacturer.

Consider Variety of Tank Engines Ordnance engineers will venture no opinion concerning what engine may be selected. A gasoline type is desired because of the universal availability of fuel, although an engine capable of operating on either gasoline or distillate is near perfection. The fire hazard is not the problem supposed. Even a diesel-powered tank will burn like a torch if an ammunition fire is started within the vehicle. Our present tanks are practically immune to the "Molotov cocktail" because the gale-like draft through the engine compartments snuffs out flame instantaneously.

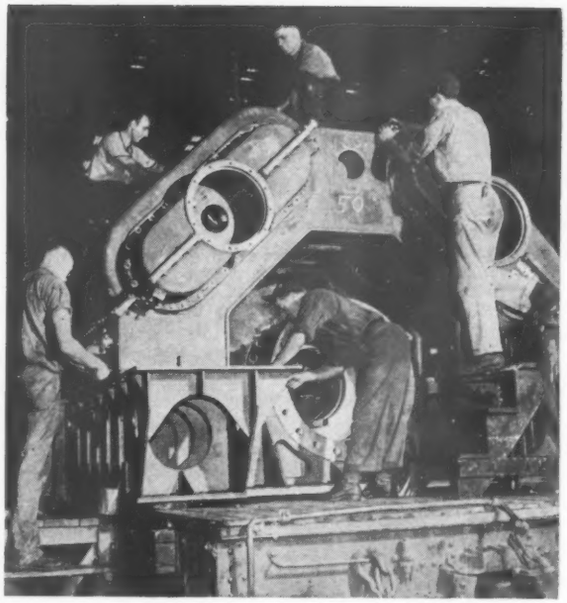
It is known that the Wright air-cooled motor produced in large volume by Continental is held in great favor by tank engineers for the ultimate choice of standard power plant. The air-cooled motor will operate under extremes of temperature without cooling or freezing troubles. Second it is lighter per housepower and fits better into the drive compartment. Third, aircraft motors have been known to function for hours after a bullet has passed through a cylinder or two.

Ford V-8 Engine May Win Favor Although Ordnance won't say whose motor will get the nod, it is quite evident that General Motors twin-diesel job and Chrysler's arrange-

To Give A. A. Shells That Luxury Ride—Fisher Body Div. of General Motors Corp. now manufactures breech housing mechanisms for naval anti-aircraft guns. Though weighing several tons as rough forgings, extensive machining and precision work trim them to less than half original weight

ment of five auto engines driving a bull gear may be considered to have served a stop-gap purpose. To those who have seen the development of the Ford engine, it is quite evident where the dark horse is stabled. This engine is a V-8 job standing about as high as a man and delivering a lot more brute power than the air-cooled motor of present design. And there is one significant sentence in Ford's announcement that M4 tanks are now rolling from its assembly lines: "Even the tough compact engine can be lifted out and replaced or repaired with comparative ease." The Ford engine was developed of course with these objects in view: reliability, simplicity and ease of manufacture. The former Lincoln engine plant was converted months ago to produce this tank engine in quantity.

Three different designs of infinitely variable-speed transmission for medium tanks are now under consideration. In a way, these devices are blown-up from the Hydra-Matic transmission used first on Oldsmobile cars and currently employed by Cadillac on its new design light tank. The field experience with the Cadillac tank has been so satisfactory in respect to the mobility imparted by the automatic transmission, that Ordnance has decided to provide medium tanks with an automatic drive. Obviously, tanks so equipped operate to best advantage over changing terrain, courses and obstacles, do not hesitate while gears are being shifted, operation of the motor at excessive speed — a cause of breakdowns — is avoided.



Lighter, Still Strong —New methods of fabricating marine gear casings of cast steel and steel plate has reduced weight by more than half. Turbine and gear casings are necessarily strong and sturdy to avoid distortions, withstand pressures that are high or widely variable. Casing in the scene is being readied for shipment from one of General Electric's plants

Steel Treads Have Been OK

While the particular make of transmission has not yet been picked, Col. Colby acknowledges that the manufacturing problems and procurement of necessary equipment will be matters of major concern. Nevertheless, it is proposed that the transmission chosen should be farmed out as an "industry proposition," rather than relying upon a single source.

Thread wear on American track-laying equipment is not the bugaboo popularly supposed, according to Col. Colby. Some tanks have operated under battle conditions for 32 days of continuous fighting, traversed 2000 miles and not had a break-down from tread wear. In Africa, the littoral is not sand-covered in most fighting areas, rather it is usually hard rock-strewn soil. The rubber treads have been completely worn off on such terrain (the worst for tank operation) but the tanks ran at least 1000 additional miles without apparent damage to the tread crossbars remaining. Tanks are not often stopped by enemy hits in the exterior driving mechanism. The secret of our successful tread operation lies in a rubber joint in the track link, not the surface material of the tread. We could use steel treads entirely.

WAR RULINGS IN BRIEF

Checklist of Significant Regulations on Materials and Prices

BARBED WIRE—Manufacture of non-essential types and styles of such wire products has been prohibited, only one type being permitted to be made. (Schedule 3 to Limitation Order L-211.)

CHROME ORES—Dollars-and-cents maximum prices have been announced to stabilize ore costs for producers of ferro-chromium, chromium chemicals and chrome refractory products. (Revised Procedural Regulation 1, Maximum Price Regulation 258.)

COPPER—Continuation of strict control placed upon the use of this metal in manufacture of farm tractors, engine power units has been announced. (Supplementary Limitation Order L-170-a.) At the same time Order L-26-c, formerly containing these controls, has been revoked.

INDUSTRIAL DIAMONDS — No rough diamonds not incorporated in tools and other devices may be sold, delivered or accepted except under limited specifications. (Amendment 2, Preference Order M-109.)

IRIDIUM—Prices at which the Metals Reserve Co. may buy idle or excessive stocks of this metal as well as iridium alloys and iridium-containing scrap from manufacturing jewelers has been announced. (Order 7, Maximum Price Regulation 204.)

MACHINE TOOL DELIVERIES—New directions for scheduling such deliveries for the armed services to give special emphasis to aircraft requirements have been issued. No change in existing division of new machine tools between armed services and other buyers has been made. (Amendment 3, Preference Order E-1-B.)

MOLYBDENUM—Permission to deliver small amounts without applying for an allocation has been formalized. (Supplementary Order M-110-a.)

PURCHASE ORDERS—Regulation which set up the allocation classification system, requiring that all orders bear designated end use symbols has been revoked. However, requirements of Preference Order M-17 and orders in the M-21 series remain mandatory. (Revocation of Priorities Regulation 10.)

REPAIR AND MAINTENANCE—Top priority rating of AA-1 may be applied to essential repair and maintenance for productive industrial facilities.

SCRAP, SALVAGE, WASTE MATERIALS—Announcement has been made of elimination of individual sellers of such materials from the scope of an OPA procedural regulation designed for speeding price adjustments. Fifteen specific price schedules and regulations on scrap materials have been excluded. (Amend. 1, Supplementary Order 9.)

STEAM EQUIPMENT — Manufacturers of power equipment have been instructed to submit monthly reports covering existing production schedules. (Limitation Order L-117.)

STEEL DRUM CONTAINERS—And parts in hands of manufacturers may not be sold or delivered, excepting flanges, plugs and cap seals, without specific authorization. This ruling likewise applies to persons making drums for their own use, prohibiting them from using any without authorization. (Preference Order M-255.)

USED EQUIPMENT—Manufacturers and processors may sell this equipment and supplies without reference to ceilings established. However, those who make a business of buying and selling such equipment are in no way affected by this regulation. (Amendment 32, General Regulation.)

WARTIME WASHINGTON

BY BLAINE STUBBLEFIELD

African Front is raising morale, and it is hoped, production; affects food producer more than munitions maker. Pepper-Kilgore bill would reorganize war administration. Japs lack tools

African Front But Little Felt Opening of a second-front in North Africa is a great pepper-upper, but it doesn't make as much difference as you might assume offhand to the man in the factory who's turning out the stuff. Ever since last June, when the military decision was made, production policies have been angled toward the present campaign. There are some exceptions, of course. Food production, for instance, is being greatly and suddenly stepped up in preparation for feeding occupied countries. But the munitions producer will be much more affected by such moves as the current program of cutting down inflated contracts and the effort in connection with the Controlled Materials Plan to substitute scheduled-output contracts for those merely naming a delivery date than by a second front.

Although production plans are changed by the military situation, many production problems may be eased. War agency administrators are hoping for a sharp upturn in factory morale. October was a bad production month, with most of the output curves turning downward together for the first time since the November before Pearl Harbor. They are hoping now for the same kind of spurt this November that the outbreak of war touched off.

The Administrator's own morale has already improved. Donald Nelson doubtless knew what was coming, but few civilians below his level did. Men who were trying to put production on a rationally programmed basis through such devices as the new Controlled Materials Plan (*AM*—Vol. 86, p. 1318c) had been troubled by the fear that the military high command had no clear idea of what they wanted.

Now the civilians realize that their inability to get a clear line from the military on production goals was due not so much to ineptitude but to a basic debate extending through June on the kind of second front for this year. And it's assumed that the present action implies a fairly definite military program extending into next year.

Reorganization Bill Interesting If you enjoy speculating on what would be the right set of organizations to create in Washington if we could begin the war all over again and start fresh, you'll enjoy reading the bill to reorganize the war agencies which Senators Pepper and Kilgore introduced this month.

Few in Washington are inclined to question the administrative beauty of the over-all Office of War Mobilization which the Pepper-Kilgore bill would create. Even fewer expect that the measure will get anywhere. Closely following the recommendations of Rep. Tolan's Committee, the bill would put under a director of war mobilization: (1) An Office of Economic Stabilization, much the same as Byrnes' present outfit. (2) An Office of Manpower Supply, combining the present Manpower Commission with a Selective Service System in which draft boards would be stripped of their autonomy. 3. An Office of Technological Mobilization. 4. An Office of Production and Supply which would be the present WPB plus armed services' procurement functions.

Genthe

HEADS WPB RESEARCH

Dr. Harvey N. Davis, president of Stevens Institute of Technology, has been selected to head the newly created Office of Production Research and Development, WPB. The office is intended to assure rapid appraisal and effective use of materials, processes, mechanism and inventions.

Procurement Pattern Set This last change would be the biggest practical effect if the bill went through—and the day is past when much excitement can be stirred up over this issue. The pattern of procurement, for better or worse, has now pretty well jelled, and transfer of the procurement power to civilian hands couldn't make much difference. The Administration made its decision on this last January when Donald Nelson was organizing WPB. And critics of the present war organization are not the ones to maintain that the history of Donald Nelson encourages a belief in one-man control as the solution of all problems.

Shortages Are Not Reliable Japan is having machine tool trouble. It may hurt them, but it won't win the war for us. We've had our wistful stories about Germany running out of oil and rubber and manpower. We've heard that the Japs couldn't fly, couldn't shoot straight, and had only seven million tons of steel per year. The lesson is that you can't trust an enemy with a shortage or a deficiency.

Nevertheless, Japan's difficulties in retooling for new models of airplanes, tanks and guns will help us to fetch them down weeks or months earlier than we might otherwise.

Japan, like all other belligerents, must constantly redesign its weapons in order to stay in the war. Every change takes new tools or new tooling. The Zero plane is a case in point. It has excellent climbing and turning characteristics, but those are not the right features to meet heavily-armored, heavy shooting, fast and durable American planes. The Zero will have to be re-designed.

As everybody knows, Japan imported a large volume of machine tools from the United States, from England and from Germany. The German source was increasingly smaller as the Nazis prepared to fight. It is, and will be, difficult for the Japanese to produce tooling for these foreign-made machines.

Imported, Made Machine Tools Some of Japan's imported types they also manufactured themselves, under license from the exporters. Those types they can retool as easily as they can retool their own designs.

The total import of machine tools by Japan is not known. Authorities here could only guess, but they believe that Japan, during recent years, manufactured more than half its total requirement of machine tools.

Canada's War Production to be Coordinated More Closely to That of the United States

OTTAWA—Canada's war production program for 1943 is being planned for closer synchronization with that of the United States. More of the Dominion's output of fighting equipment will go to global battlefronts through the direction of Washington than heretofore. Canadian war plants are likely to slow down on lines of production in which the U. S. is reaching maximum output and divert capacity to lines in which this country is still ahead of its neighbor.

Inclusion of Canada in the Combined Production and Resources Board (with Munitions Minister C. D. Howe as representative) means that this country's home-front operations will be pretty well scheduled by that body. But an influencing factor in the direction of the Canadian effort is the necessity of balancing the exchange of war materials between the United States and Canada. Up until the present Canada has been sending the bulk of its war output to global fronts on the order of Britain and financing the purchase of steel, machine tools and other needed supplies from the U. S. largely by close control of U. S. exchange and the sale of the Canadian gold output to the Washington government. With gold production being curtailed in sympathy with U. S. policy Canada has to sell more direct war goods to the U. S. in order to pay for war supplies which can only be obtained below the border.

Most of Output to United Nations

At present Canada is turning over 70 percent of its total war output—which will be close to three billion dollars for this year—to the United Nations and 50 percent is going to the order of Britain for Empire purposes, or Russia. War goods worth more than $100 millions have been shipped directly from Canada to Russia. Twenty percent of the Canadian output goes to Pacific fronts on the order of Washington. Next year it is expected that a much larger percentage will be delivered to the order of the U. S.

Increasing emphasis is being placed on shipbuilding and Canadian yards now compare in production methods with those of the U. S. A recent parliamentary committee survey disclosed that shipbuilding plants at Vancouver are equalling the high rate of output attained by Pacific Coast plants in the U. S. By the end of the year the Dominion will have 1,000,000 tons of merchant shipping in service and will add at least 500,000 tons next year.

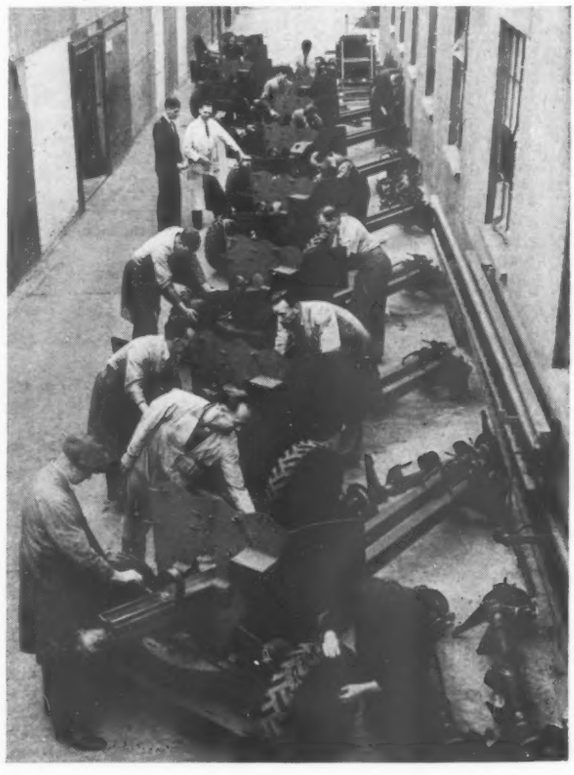
Aircraft production by Canadian plants will run to 5,000 planes this year compared with 100 units in 1939. Nearly all of the engines are now obtained from the U. S. but high efficiency has been attained this year in the fabrication of various body types. Two or three of the largest Canadian plants are building planes for the United States. The now famous Mosquito bombers in use by the British against German industrial plants are being turned out in this country exclusively of molded plywood. The bulk of machine tools required by Canadian war plants are now produced in Canada—a development of the last ten months.

Ottawa Won't Tell

Ottawa is secretive about reasons for the expropriation by the government of the big aircraft plant of National Steel Car Company at Malton, Ontario, near Toronto, but the immediate background of the action is understood to have been the failure of the company to fall in line with the Labor Department's increasingly emphasized policy of insisting on management-worker cooperation in war industry. National Selective Service Director Elliott Little has been campaigning for the introduction of management-worker committees in war equipment factories and the reluctance of the Steel Car Company to go along with this plan is given as the cause of labor difficulties which are claimed to have retarded production. The Malton plant has been working on an order for Lancaster bombers. In other cases of labor difficulties in war plants Ottawa has taken over control of management but has not before taken possession.

Increasing coordination and dovetailing of U. S.-Canada war production will revive the question, discussed between Washington and Ottawa at various times over the last two years, of an exchange arrangement which would wash out the disparity between the exchange value of American and Canadian dollars. Earlier this year it was reported here that Washington financial authorities, including Secretary Morgenthau, favored an agreement which would bring Canadian exchange to parity with U. S. dollars but Ottawa economists were opposed to the move largely because it would have the effect of raising the value of Canadian currency in relation to Sterling and thereby entail a heavy loss for Canada on large exports of war equipment and food supplies to Britain. Another factor which left Ottawa cool to the plan was the substantial profit for this country on exports to the U. S., which helped to solve Finance Minister Ilsley's exchange problem. Exports which produced a large part of the premium profit for Canada, such as newsprint have fallen steeply since the early part of 1942 and the advantage to Canada from the disparity in exchange has diminished.

It is now contended in many quarters that if trade between the two countries for the balance of the war period is to be mainly in war goods Ottawa's objection to parity loses force and war business would be facilitated by equality of exchange values. Revival of the question is being linked with hints by Munitions Minister Howe that Canada's war production is to be coordinated more closely with that of the U. S. following his participation in the



Lethal Baby Carriages — Canada is producing thousands of the new six-pounder gun. Shown is a scene at a Ministry of Supply factory, during the assembly of the carriage top

LINES ON AIRCRAFT

Air experts still look askance at Higgins' proposed wood-plastic cargo planes. His use of publicity as a lever annoyed both Air Force and Maritime Commission

Biggest show in aircraft production this fortnight is Andrew J. Higgins' proposal to build 1,200 wood-plastic cargo planes and one experimental six-engined behemoth to carry several times the load of Martin's Mars. These planes, plus airplane parts and engines, are to be produced in a new plant to cost $30 million, and to be located on the New Orleans site of Higgins' Liberty ship yard, which was stopped when only ten percent completed, by order of the Maritime Commission. Shortage of steel, and unexpectedly fast delivery of ships by existing yards, was the reason for suspending the Higgins yard.

Not an official word had been said about the Higgins airplane program at this wr'ting. All the talking had been done by Mr. Higgins himself, and by off-the-record sources, with embellishments by reporters. What happened was this: According to government officials a Washington newspaper got a detailed and probably accurate story of Higgins' negotiations with the Air Force from a WPB executive, and printed it. Higgins saw the story after he returned to New Orleans, called a press conference, and told it again.

There is no doubt that the dynamic builder of attack boats for the Navy has a firm deal on with the Air Force. The President himself, sold on Higgins and on the proposition that the abandoned shipyard ought to be re-occupied, is backing him for a big job. The Air Force, probably unwillingly, has agreed to let Higgins try to build the 1,200 two-engined wooden cargo planes after the Curtiss-Wright C-76 design. But the Air Force would prefer to deal with experienced airplane builders. Both the Air Force and the Maritime Commission are annoyed with Higgins for talking out of turn, and, they say for using the press in the manner of H. J. Kaiser to gain his objectives. The Maritime Commission says he complained first because the abandoned shipyard facilities were not removed, and then when Commission forces began dismantling, he complained because they wouldn't get out of his way.

The Higgins shipyard was about ten percent completed when the stop order hit it. Installations consisted of personnel accommodation buildings; 50 percent completion of a ship canal, earth from which was used to fill 400 acres of land; a good deal of wood piling driven; extension of utilities; a $10,000 water tower. Little or no work had been done on the power plant. Several concrete plant building foundations were poured. Of scores of cranes ordered, few were manufactured and only five were delivered. Obviously Higgins can use the personnel buildings, the tower, utilities. There is no plant building, no equipment, no tools of any use to him. A Maritime Commission liquidating committee is removing everything of any use to other shipyards.

No, Not Ray Guns— Electric guns designed by Westinghouse to facilitate the work of "shooting" heat into explosive rivets for airplane assembly, draw key parts from peacetime products: A heater from the electric range and a thermostat from the electric iron. When heat is applied, a small explosive charge in the rivet is set off, automatically capping it

"Manufacturing laboratory" is what Higgins calls his project. He says it includes the manufacture of airplane accessories, the manufacture of a new type of "wood alloy" which seems to be plastic wood re-inforced with metal mesh, and a new type of engine. He would say only that the engine is of a low-fuel-consumption type, and the first to come off the assembly line will be for marine use. Higgins said that he probably would have to borrow engines for his first airplane, because "I intend to build it so damned fast that I won't have time to build engines of my own." Mr. Higgins is not troubled by an inferiority complex.

His six-engined plane will be five times as big as Martin's Mars, if his statement that it would carry 200,000 pounds was understood correctly. That is 100 tons of cargo, or five times the cargo the Navy plans to carry in the Mars when its conversion from patrol bomber to transport is complete. Aviation engineers eye Higgins' plans on aircraft as rather unsophisticated. Glenn Martin, Grover Loening, and many other air engineers agree that planes of the size proposed are perfectly feasible, and there is no reason why they cannot be built of wood and some steel. Mr. Higgins stated to AMERICAN MACHINIST that, "we have not given and are not yet ready to give details of large cargo planes."

Anything can happen to Higgins' venture. At this writing he didn't yet have a contract. Beyond doubt many officials in the Army would like to expand existing airplane plants, if expansion is necessary, rather than worry with a new one. United Nations high command has not yet fixed upon a program of air transport on a large scale, and might not, depending on turns of the war. Higgins might fail to produce, as many aircraft engineers predict he will, in which case another stop order will hit him. Come what may, the Manpower Commission can hardly object to his consumption of manhours, because he says that, of 60,000 workers that will be needed, 50,000 of them will be women. It is entirely possible that Higgins might carry out his entire program.

AMA Speaker Predicts a Permanent Place in Industry for Labor-Management Committees

NEW YORK—The work of labor-management committees was lauded by W. G. Marshall, chairman of the War Production Drive Policy Committee and vice president in charge of industrial relations of the Westinghouse Electric and Manufacturing Co., speaking here before the production conference of the American Management Association, recently. "The fundamental underlying principle of the War Production Drive is that labor-management committee work goes to the very heart of labor-management cooperation," he stated. "In my judgment the movement will live long after this emergency and on through prosperous and depression years in varying degrees of operation.

W. G. MARSHALL

Underwood & Underwood

HAROLD V. COES

E. J. TRIBBLE

Training Program

C. R. Dooley, director, Training Within Industry Division, War Manpower Commission, and Clifton Cox, assistant director, New Jersey District of Training Within Industry, told of the organization of this program, and of the results attained thus far. Mr. Cox described the Job Methods Training program which TWI is now making available to industry, and demonstrated how it could be applied to a simple riveted assembly.

E. J. Tribble, assistant works manager, Worthington Pump and Machinery Corp., spoke on methods of production control. Under the system his company has devised, the production department is organized around two major functions: Overall coordination of the flow of material in terms of customers' orders and detailed coordination of the flow of material across the machine tools or work floors in the various departments.

Harold V. Coes, vice president of Ford, Bacon & Davis, Inc., discussed the problem of keeping production equipment in continuous service and of maintaining accuracy and precision despite 168-hour work weeks, green operators and inexperienced oilers and repairmen. The essential basis for preventive maintenance, he said, is planning and scheduling repairs, major overhauls and rebuilding. Another key to success in satisfactory maintenance work is careful selection and training of men. Parts and other materials must be assembled and ready for use.

Ivan L. Willis, director of industrial relations, Curtiss-Wright Corp., was chairman of a panel session concerned with the problem of absenteeism. Other members of the panel were A. T. Court, Labor Economics Section, General Motors Corp., G. G. Mitchell, assistant manager of service, Remington Arms Co., Frances M. Smith, personnel manager, Murray Manufacturing Corp., C. Spencer Phillips, personnel manager, Revere Copper and Brass Inc., Charles A. Wood, director of industrial relations, E. R. Squibb and Sons, and L. H. Webb-Peploe, Lever Brothers Co. The problem of absenteeism in industrial plants was reported as assuming formidable proportions.

The negro worker, and the problem of his employment in industrial plants, was the subject of a ound table discussion under the chairmanship of Alvin E. Dodd, president, American Management Assn. Other participants included Ellen M. Davies, personnel manager, Waterbury Mfg. Co. plant, Chase Brass & Copper Co., George F. Havell, executive vice president, Council for Democracy, L. Kenneth Mayer, comptroller, Manufacturers Machine and Tool Co., William D. Plumb, vice president and purchasing agent, Fayette R. Plump, Inc., Floyd B. Shannon, chief of employment division, Kearny plant, Western Electric Co., Albert F. Snyder, personnel superintendent, Winchester Repeating Arms Co., Division of Western Cartridge Co. and Ivan L. Willis, director of industrial relations, Curtiss-Wright Corp.

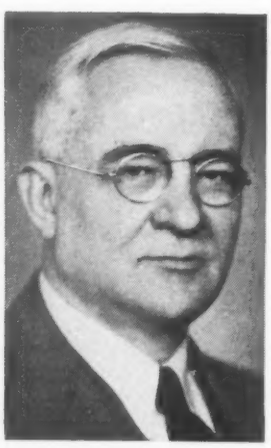
"Manning Tables"

The only draft-proof jobs from now on will be those that require a minimum of three years' training, Lt. Col. H. J. Schwabacher, liaison officer for the Service of Supplies, WMC, declared. The new system of deferments becomes effective with the issuance of the "Manning Tables," which provide for the listing of the personnel requirements of essential war industries according to job classification. Each plant will file an inventory of its jobs, together with information on the length of time that would be required to train replacements for the workers now employed and occupational deferments will be on this basis.

L. C. Morrow, editor, *Factory Management and Maintenance,* stated that the goal of American industry is the production of enough essential armament and other material to equip and maintain United States fighting forces of at least nine million men, as well as carrying-on the lend-lease program. The rate of production, he emphasized, must pass that of Axis countries.

Ruesart Studio

J. M. TALBOT



C. R. RIKER

A. T. COURT

Mr. Morrow was chairman of a round-table discussion on "Making Suggestions Systems Work." Other participants were F. A. Denz, manager, Employees Suggestion Conference, United Air Lines Transport Corp., Ray Millholland, chairman, Board for Individual Awards, War Production Drive Headquarters, Montgomery R. Budd, explosive department, Hercules Powder Co., E. Stewart James, chairman, Suggestion Plan Committee, Curtiss-Propeller Division, Curtiss-Wright Corp., H. C. Marmaduke, manager, Employees' Suggestion System, Illinois Central System, Douglas McGregor, Industrial Relations Section, Department of Economics and Social Science, Massachusetts Institute of Technology, and H. W. Seinwerth, manager, Suggestion Plan, Swift & Company.

Ralph T. Seward, associate public member, National War Labor Board, declared that the board had three major problems to solve on the subject of wage stabilization: Jurisdictional, policy and the machinery through which applications for wage increases must pass.

"Women in the Factory" was the subject of a panel discussion under the chairmanship of Samuel L. H. Burk, chief job analyst, Atlantic Refining Co. With him in the panel were Mary Anderson, director, Women's Bureau, U. S. Department of Labor, Esther R. Becker, staff assistant, New Jersey District, TWI, Ellen M. Davies, David Mack, employment manager, Wright Aeronautical Corp., and James M. Talbot, vice president, S. S. White Dental Manufacturing Co.

Mr. White said that previous concepts of wage rates as between men and women will have to be changed and that equal wages for equal performance will have to be granted on job evaluation.

NAMES in the NEWS

Raycroft Walsh, who was formerly vice president of United Aircraft Corp., has been elected senior vice president. General manager of the export division, J. Reed Miller, has been appointed a vice president of the corporation.

William F. McCarthy, vice president of Henry Prentiss & Co., was given a testimonial dinner by the Metropolitan machine tool dealers at the Advertising Club of New York. He was presented with a suitable remembrance symbolizing the esteem of all present.

George M. Stevens has been appointed acting manager of the River works of General Electric Co. and Nicholas M. Du Chemin has become acting manager of the West Lynn works, succeeding the late Nelson J. Darling. Mr. Stevens joined the company in 1899 and has been assistant manager of the River works since 1940, while Mr. Du Chemin became connected with G. E. in 1914 and has been assistant manager of the West Lynn plant since 1935.

W. E. Griffiths, who was formerly manager of the product development department of Allegheny Ludlum Steel Corp., has been named assistant manager of sales, flat rolled products.

George C. Brainard has resigned as director of the Tools Division of the War Production Board and is returning to his position as president of General Fireproofing Co. He was chief of the Tools Branch until it became a division of WPB.

D. A. MacKinnon has been named hydraulic sales engineer of Hydraulic Machinery, Inc. He was for several years with Vickers, Inc., and has been sales engineer at Sundstrand Machine Tool Co. since 1940.

Edward S. Coe, Jr., has been made manager of the New York office of Farrel-Birmingham Co., Inc. He has been connected with the firm since 1936 and for the past few months has had charge of expediting production of Farrel-Sykes gear generating machines.

J. L. Townsend has been appointed assistant manager of sales of the fractional-horsepower motor section of the Motor Div. of General Electric Co. In 1925 Mr. Townsend joined the company as a student engineer at the Ft. Wayne works. From 1926 to 1937 he was located in the Detroit and Grand Rapids offices, then returned to Ft. Wayne in the fractional-horsepower motor sales section.

George F. McLaughlin has become director of production for Jordanoff Aviation Co. and will make his headquarters in the New York offices.

John L. Schmeller has recently been appointed president of National Bronze and Aluminum Foundry Co. Other officers include W. F. Muth and George N. Wright as vice presidents.

Harry Woodhead has become president of Vultee Aircraft, Inc., Downey, Calif. He succeeds R. W. Miller who recently resigned. I. M. Laddon has been named vice president of Vultee. Mr. Woodhead is president of Consolidated Aircraft Corp. and Mr. Laddon is vice president and general manager and both will continue in those capacities.

Russell L. Whitney has been appointed sales manager of the Transformer Div. of Westinghouse Electric & Mfg. Co. at Sharon, and A. C. Farmer, formerly assistant sales manager, has been named assistant to the vice president. For the past six years Mr. Whitney has been sales manager of the porcelain department in Derry, Pa. Mr. Farmer joined the company in 1909 and became assistant sales manager in 1932.

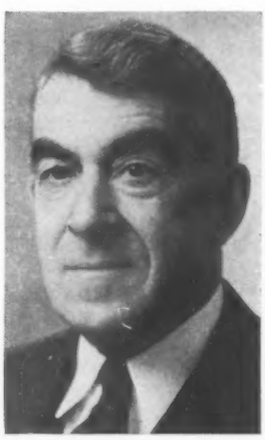
Carl A. Salmonsen has been named assistant manager of the River Works of General Electric Co. at Lynn. He has been connected with the company since 1909 and in 1941 was placed in charge of one of the manufacturing divisions at the Lynn works.

BUSINESS ITEMS

Wilkening Mfg. Co., is building a new plant in eastern Pennsylvania for the production of piston rings for aircraft.

Hydraulic Machinery Inc. has begun construction of a new plant in Dearborn which will combine the activities that have expanded to a second plant at Elizabeth and general offices at

G. E. River and West Lynn Works Acting Managers



G. M. STEVENS

N. M. DU CHEMIN

Vultee President *New G.E. Assistant Sales and Plant Managers*

H. WOODHEAD

J. L. TOWNSEND

C. A. SALMONSEN

Grand River in addition to its location on American Ave.

Glenn-Roberts Co. has opened a branch factory at Indianapolis to meet the requirements of the company's eastern and midwestern customers. The sales headquarters for that area have been moved from Chicago to the new plant. James E. Vosburgh, who has been associated with the organization since it was founded, heads the staff as general manager.

A. H. Philpot, metallurgical engineer, has been appointed by Copperweld Steel Co., Warren, Ohio, to manage its Washington District office. Mr. Philpot will be active in the sale and application of the company's alloy and tool steels.

George Keller Machinery Co., Buffalo, has been named representative of Baker Brothers, Inc.

J. E. von Maur will represent the American Gas Furnace Co. throughout Ohio with offices at 63 S. High St., Columbus and 715 Prospect St., Cleveland. The Verkamp Corp., Cincinnati, will act as Mr. von Maur's sub-representative in the southwestern part of the state.

OBITUARIES

Major General William Crozier, 87, formerly chief of Army Ordnance and member of the War Council during the first World War, passed away after a brief illness. He was a designer of ordnance material and for more than forty years had a marked influence in the development of the fighting equipment of this country. During World War I, General Crozier served as advisor to President Wilson and conferred with Winston Churchill, then Minister of Munitions, in developing an effective pooling of weapons and ordnance equipment for the Allied armies. Two years ago, in recognition of his great contributions to the cause of American preparedness, the Army Ordnance Assn., of which he was a founder, established the Crozier gold medal.

Stanley B. Lafferty, former president of the Red Jacket Mfg. Co. died in California recently after a short illness at the age of 83. He retired from the company several years ago.

Frederick Van Voorhees Lindsey, 64, vice president and general sales manager of Driver-Harris Co. passed away after a brief illness. He was connected with the company since 1925.

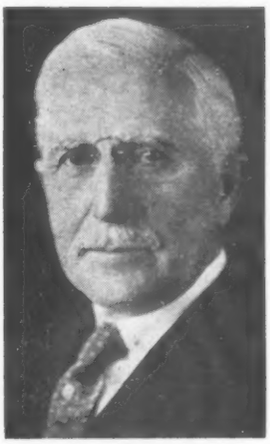
Julius Kahn, 68, former president of Truscon Steel Co., died in Cleveland following a brief illness.

George Matthew Verity, founder of the American Rolling Mill Co., died recently of a heart attack, at his home in Middletown, Ohio. He had long been a zealous exponent of practical industrial democracy. To him the industrial development of America and the improvement of relations between men and management were synonymous.

Entering the steel business in 1889, he became one of the outstanding industrial leaders in America, and the dean of all present day steel executives. After organizing the American Rolling Mill Co. in 1899, he lead its growth from one small plant, employing 350 men, to a world-wide institution employing many thousands.

Mr. Verity was the first to introduce in the steel industry such innovations as mutual benefit associations, group life insurance, a liberal wage policy, the eight hour day in departments operating around the clock, and many other things which are a standard part of industrial relationships today. He was also keenly interested in the civic lives of the communities in which Armco plants were located.

He was an honorary vice president of the American Iron and Steel Institute and a director of Westinghouse Electric and Manufacturing Co., Cincinnati Branch of the Federal Reserve Bank, Fifth-Third Trust Co. of Cincinnati, and of Middletown Banks. He was also a member of the advisory committee of the National Industrial Conference Board, New York, and a member of the Ohio Society of New York.



GEO. M. VERITY

Bennet B. Bristol, 74, for many years treasurer of the Foxboro Co., died at his summer home at Falmouth Heights.

Francis Hervey Payne, 74, president of the American Meter Co., died in Erie, Pa., after a heart attack.

William Salt, head of the service department of De Laval Steam Turbine Co. for many years, recently passed away.

James B. Strong, 66, died at his home in Setauket, L. I. He was retired as president of the Ramapo Iron Wks. and had held executive positions in several manufacturing companies.

MEETINGS

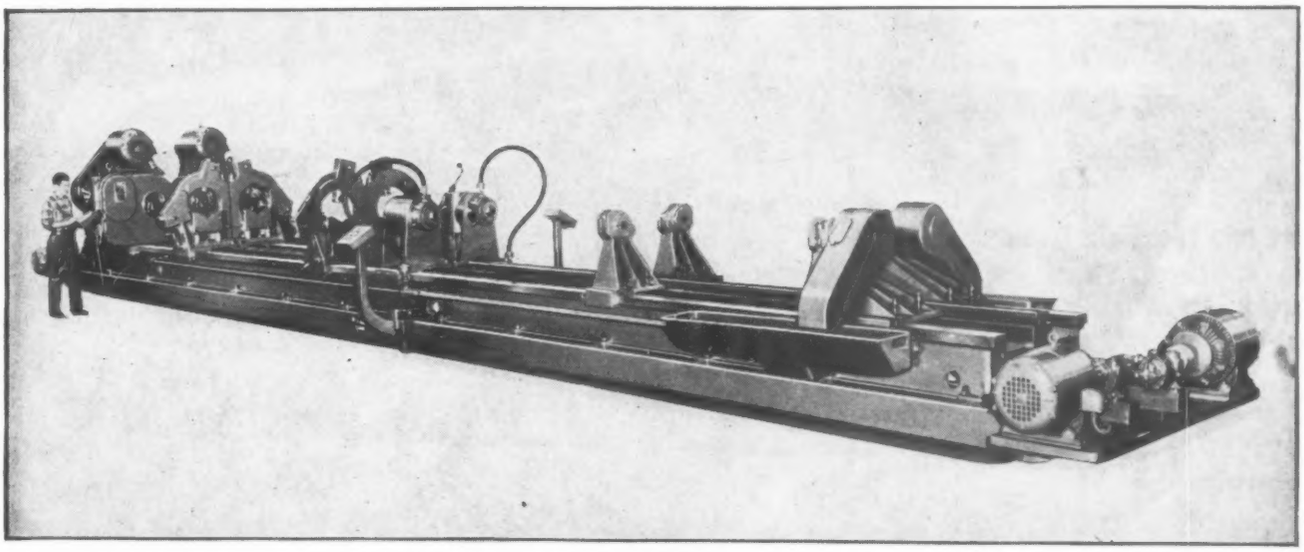
American Society of Mechanical Engineers. 63rd Annual meeting. Hotel Astor, New York, N. Y. Nov. 30-Dec. 4.

National Association of Manufacturers. Annual meeting. Waldorf Astoria Hotel, New York, N. Y. Dec. 2-4.

National Exposition of Power and Mechanical Engineering. Madison Square Garden. Nov. 30-Dec. 4.

American Standards Association. Annual meeting. Hotel Astor, New York, N. Y. Dec. 11.

SHOP EQUIPMENT NEWS



W. F. & John Barnes Deep Hole Drilling and Boring Machine Operates Simultaneously in Two Independent Cycles

For drilling and boring two parts simultaneously in completely independent cycles W. F. & John Barnes Co., Rockford, Ill., has brought out the 445 independent, two spindle deep hole drilling and boring machine. Each work piece is driven by independent headstocks and is supported by separate steadyrests. The tools are fed by independent hydraulically actuated slides. The steadyrests are of three-point roller type having adjustment on each of the rollers, each of which is carried by a double row of tapered roller bearings. The screw adjustment for each of the rollers allows the handling of work from 5 in. minimum to 16 in. maximum outside diameter. The top portion of each steadyrest is hinged to facilitate handling when loading and unloading. Incorporated into the steadyrests is a V-locator moved by a hand crank which provides support for the work piece and prevents possible injury to the rollers or steadyrests by careless handling when loading and unloading.

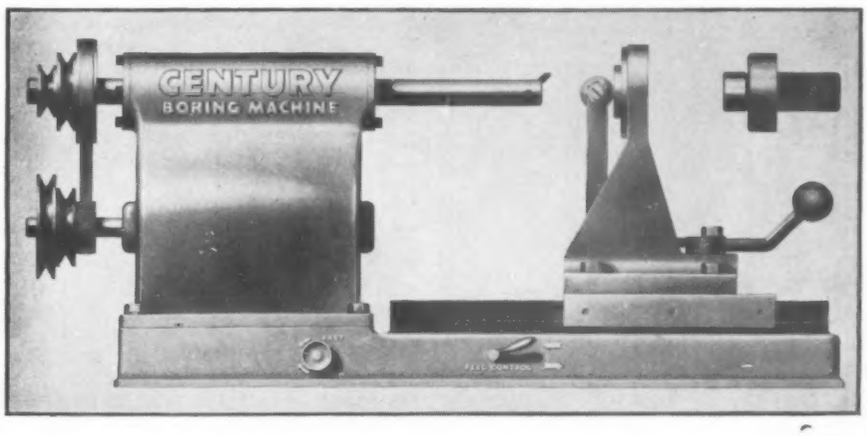
Levers at the top of the quill support brackets operate two quill type tailstocks manually advanced by rack and pinion. The quills are clamped in position by moving the levers toward a vertical position, which locks the rack by cam action. The tailstocks are clamped to the ways in the same manner as the steadyrests and headstocks.

The whip supports and toolholders are mounted on accurately scraped ways. The supports are positioned midway between the toolholder and the tailstock at the beginning of the work cycle. Spring of tool shanks at the start of the work cycle is prevented by the guide bushings in the whip supports. These supports remain stationary until the tool slides have been fed forward to meet them. The whip supports are then carried along the ways until the feed cycle is completed. They are carried to their original position by a latch on each toolholder controlled by dogs mounted clamped to the center way when the toolholders are traversed to the starting position.

The machine may be completely controlled from each of four pushbutton stations. Two motor driven hydraulic feed and traverse units which are mounted at the head end of the machine actuate the hydraulic feed cylinders mounted in the base. Each spindle has its own motor driven high pressure coolant pumps. Four-jaw independent type chucks 15 in. in dia. are usually furnished with the machines, but chucks up to 24 in. dia. may be used.

Century Bench Boring Machine Fitted With Removable Fixture

A bench model precision boring machine has been developed by Century Engineering Co., 816 West Fifth St., Los Angeles, Calif., for boring holes from ⅜ to 2¾ in. dia. Parts which have parallel sides adjacent to the hole are held in place by a quick-acting fixture which is removable, and other holding fixtures for unsymetrical parts can be attached to the slide which is



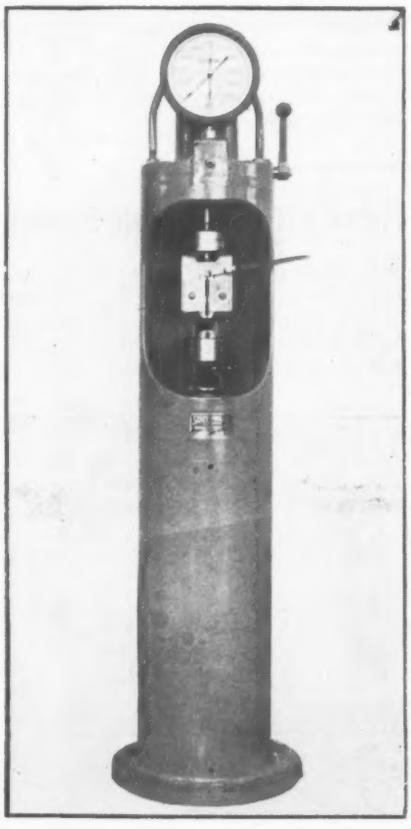
air and hydraulically operated. A small hydraulic metering valve located near the operating control adjusts the feed speeds. The fixture with its work slowly moves toward the boring bar during the boring operation and quickly retracts when the operation is completed.

The boring bar spindle is driven by 110 volt electric motor housed within the lower portion of the spindle casting. A three sheave pulley permits changes in spindle speed. Standard equipment furnished with the machine is a set of locating plugs and bushings from ⅜ to 2¾ in. dia. divided in increments of 1/16 in., to be used with the universal fixture, and six boring bars.

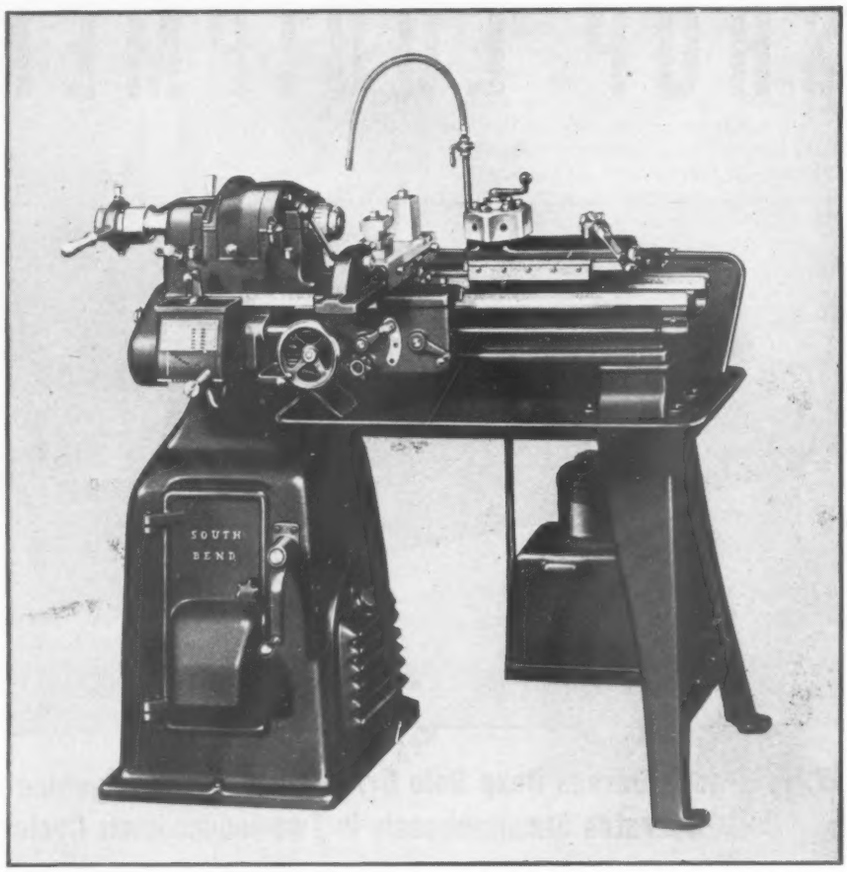
Baldwin Spot Weld Tester Checks Strength of Samples

A spot weld testing machine for checking the strength of spot welding samples has been developed by the Baldwin Southwark Div. of Baldwin Locomotive Works, Philadelphia, Pa. This is a self-contained, motor driven, hydraulic machine for light metal fabrication testing.

The machine is equipped with self-aligning, lever operated, open face grips with renewable hard file faces. Grips accommodate offsets in welded specimens from the smallest gage to ¼ in. thick. The steel base is 18 in. in dia. A hoisting hood at the top permits crane handling. The load is indicated by an 8-in. precision dial set at the top of the machine. The overall height of the testing machine is 70 in. and weight is approximately 800 lb.



South Bend Turret Lathe Does Small Chucking Work



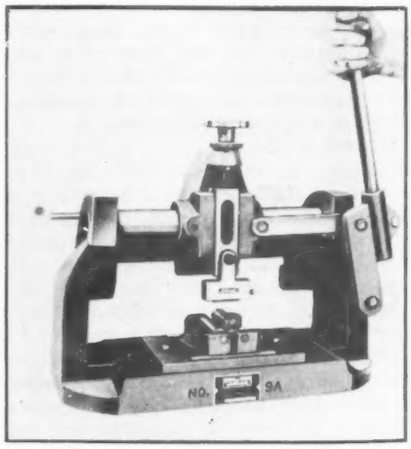
Designed for rapid production to close tolerances of small chucking or bar work the South Bend Lathe Works, South Bend, Ind., has brought out a floor type 10 in. turret lathe. Second operation work can also be handled in this model. The lathe has a 10 in. swing over the bed or saddle wings, 1⅜ in. hole through the headstock spindle and 1 in. collet capacity.

It is equipped with interchangeable compound rest cross-slide and hand lever cross-slide. This latter is furnished with front and rear tool blocks which provide positions for three tools. The hand lever operated bed turret indexes automatically and has an adjustable stop for each of the six turret tool positions. A quick change gear box supplies 48 longitudinal power feeds for the universal carriage, 48 power cross feeds for the compound rest cross-slide, and 48 thread cutting feeds 4 to 224 per in. The motor drive and back gears deliver 12 spindle speeds ranging from 50 to 1,357 r.p.m.

Acromark Parts Marking Machine Can Be Hand Or Motor Operated

The No. 9A war parts marking machine recently introduced by Acromark Corp., 7-13 Morrell St., Elizabeth, N. J., can be either hand operated or motor driven and takes accessories for marking cylindrical or flat parts. For the latter use the rotary holder with type or roller die is used. For intermittent marking or controlled spacing a geared mandrel and straight line holder assembly is used. Serial numbering is accomplished with an automatic head and repeat numbering can be performed after a single adjustment.

A pull of the lever operates the machine, producing a uniform mark of any desired depth. Another part is marked on the return stroke. The motorized unit can be operated at a set speed to suit the feeding speed of the operator. The parts marker is 14⅜ in. high, 17¼ in. long and 7¾ in. deep.



How Monarch delivers a mile of Lathes per month

The exact number is a military secret. But if you use the old method of placing them "end to end," they'll stretch out a mile, almost any month. And they're all going into the fight for Victory.

Our production in 1942 is double that of 1941, four times that of 1940. Several reasons account for this, which are listed briefly at the right.

If you can use our experience to increase your production, we are anxious to share it. We have no secrets about *anything* that will help bring Victory faster

MONARCH LATHES
COVER THE TURNING FIELD

Below are some of the more important moves we made, many of them long before Pearl Harbor, to produce Monarch lathes faster:

1. *Simplified line with fewer sizes*—concentration on sizes and types most needed in War production.
2. *Redesign of unit parts*—to permit faster production, and to reduce quantities of critical materials.
3. *Better job analysis*—intensive study of every part, to turn it out the fastest way with existing equipment.
4. *Expanded plant facilities*—more space, more machine tools, but a relatively low percentage when compared to our rate of production increase.
5. *Better tooling*—to fit the job, and with almost 100% use of tungsten carbide tools.
6. *Better plant layout*—to avoid back tracking, useless handling of materials and processed parts.
7. *Reduced "waiting time"* for materials by careful scheduling, which also reduces inventories on critical materials.
8. *Supervisor training*—continuous classes to develop competent supervisors needed to guide heavy influx of new workers.
9. *Vestibule school*—for every new man and woman employed, in which they are observed, trained and then placed where they will be most useful.
10. *Three balanced shifts*—with 7-day operation to get the most production out of every machine in our plant.
11. *Loyalty and patriotism* of every employe, who knows the lathes they build turn out implements and munitions for Victory. They know this is their fight, too, and they're doing the job.

Realizing the value of *time*, we have sacrificed everything to it, except one basic principle. There shall be no let-down in the quality and accuracy of Monarch lathes, for this means only ultimate waste instead of saving.

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

First two-star Navy "E" pennant to be awarded in Ohio flies from the Monarch plant. We're justly proud of this flag—earned by the loyalty and hard work of every Monarch employee. Some of the means we used to increase production are listed in this reprint of a recently published advertisement.

We'll build 'em . . . you use 'em!

Monarch men and women take seriously the award of this second star for their Navy "E" pennant. When they were first honored with the original pennant, in November 1941, they pledged themselves to continue to merit the confidence placed in them. And they've lived up to this pledge.

Today, they say to Monarch users, more earnestly than ever before—"We'll build them . . . you use them." Even with the amazing increase in the number of Monarchs built this year, they'll stand up and take as much work as you can feed into them. Keep them turning day and night—they won't let you down.

You'll find, too, that these Monarchs are versatile. They'll do many jobs that ordinarily are not turned on engine lathes. If you are stumped with turning jobs, our field engineers can help you.

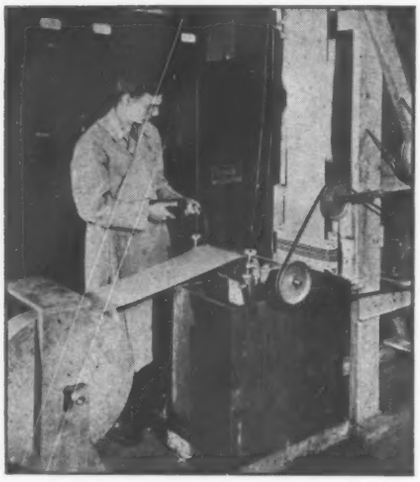
And back here at Sidney, we'll continue to build them, *faster for fighters!*

THE MONARCH MACHINE TOOL COMPANY · · · SIDNEY · OHIO

MONARCH LATHES

COVER THE TURNING FIELD

Westinghouse Induction Heating Process for Flowing Tin Plate Makes Continuous Production Possible



This test set-up in the Baltimore Radio Division of Westinghouse shows the induction coil and water quench tank

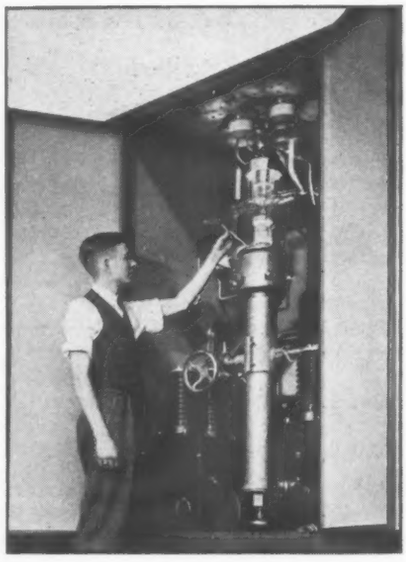
High-frequency heating at 200,000 cycles per second to melt tin electrolytically deposited on a steel sheet, saves critical tin, speeds production, increases corrosion protection and facilitates the mechanical handling of the plated sheet. The process, developed by the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., flows 12 sq.ft. of tin in seven-tenths of a second, much faster than was previously practical with gas furnaces or vats of hot oil.

This high-frequency method of using tin makes practical the final step in electrolytic tinning which saves two-thirds. The electrolytic coating of only 30 millionths of an inch on each side of the strip which is possible now, cuts 60 millionths of an inch off the coating applied by the old hot dip process. As the power input to the inductor coil, which determines the amount of heat generated can be immediately and automatically adjusted to correspond with any change in the speed of the strip, the proper temperature to melt the tin is maintained and oxidizing of the strip is eliminated.

Tin plate must have high corrosion resistance to pack foods containing acids. To provide the steel strip with adequate protection, the tin must be heated to the fusion point so as to flow into a smooth, homogeneous mixture. Electrolytically deposited tin forms a granular dull grey surface which is not highly corrosion resistant. The overall effectiveness of the tinplate is not high until it is fused and a uniform thickness obtained.

The new high-frequency heating equipment will operate at speeds up to 1,000 ft. per min. while gas furnaces are limited 150 ft. per min. and hot oil to 200 ft. per min. At present the electrolytic plating is operated at a maximum of 500 ft. per min., but in the near future this speed will be doubled to take full advantage of the high speed operation of induction heating.

The rehandling problem can be avoided since sufficient power can be generated in the sheet to heat the strip to the fusion point of tin, immediately after it passes from the plating tank. Within 0.7 of a second after the strip enters the coil, the temperature is brought up to 450 F., where the tin melts and starts to flow into an even surface. Only a few feet of line-travel is required to produce sufficient heat when the strip is passing through the inductor coil at 1,000 ft. per min.



High frequency power is supplied to the inductor heater coil by 100 kw. vacuum oscillator tubes

Thus the flowing operation can become an integral part of the tinning line.

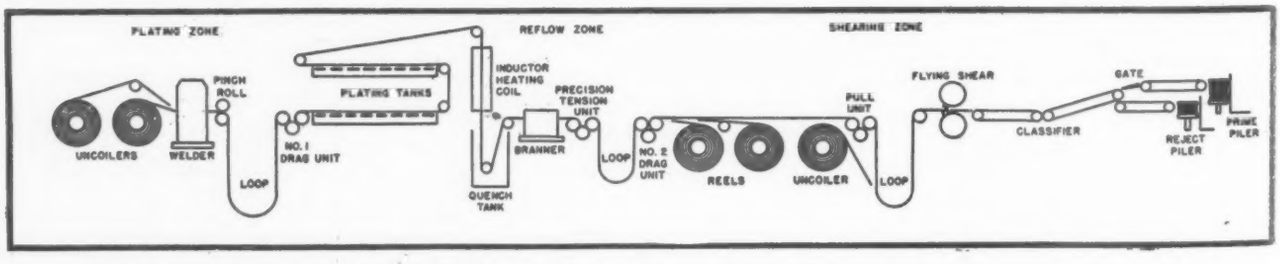
With induction heating, the power input may be adjusted rapidly to accommodate changes in the speed of the line, as during the periods of acceleration and deceleration when two coils are welded end to end. A speed change simply means a corresponding change in the power input to the heater coil. The frequency at which the required current can be induced in the strip without using abnormally high voltages depends upon the thickness of the sheet. Since tinplate is usually 0.008 in. to 0.011 in., a frequency of about 200,000 cycles per second is most practical.

The inductor heater coil is rectangular in form, wound as close to the strip as mechanically possible. It acts as the primary of a transformer while the strip itself constitutes a single turn secondary. The induced current flows across the strip paralleling the turns of the inductor heater coil. The heat generated in the strip is due to the resistance of the strip and the current flowing through it.

Power From Oscillator Tubes

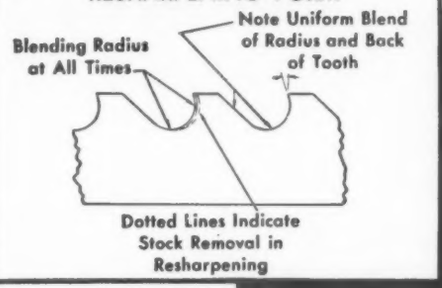
The power is supplied by vacuum tube oscillators, which are essentially the same as the transmitter of a radio station. Sixty cycle alternating current is rectified to direct current and fed to the oscillator tubes where it is converted to 200,000 cycles per second and sent out through the inductor heater coil.

The several types of tinning lines thus far developed have two basic differences. One is whether the speed through the plating bath is held constant or allowed to decrease when a fresh coil of steel is entered into the line. The other principal difference is whether the plating tanks are vertical or horizontal. In one type of mill the steel moves through the plating tanks at constant speed, and means are provided for accumulating enough slack at the entry end to allow the end of a new strip to be welded on. The other scheme, which in general allows a faster speed of strip, allows the entire line to slow down when necessary to start a new roll. In the line with horizontal plating tanks the two sides of the sheet are tinned separately allowing variation in thickness and even in kind of metal deposited, if necessary. In the vertical tank line the sheet is tinned on both sides as one operation and hence exactly alike.

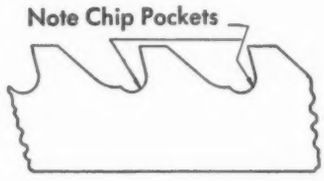


In this production line the electrolytic tinning, fusing and sheeting is a continuous, complete operation

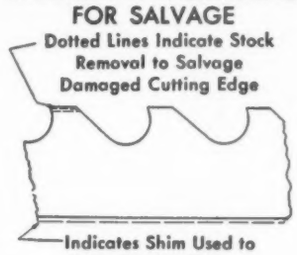
① ILLUSTRATES CORRECT RESHARPENING FORM


Blending Radius at All Times
Note Uniform Blend of Radius and Back of Tooth
Dotted Lines Indicate Stock Removal in Resharpening

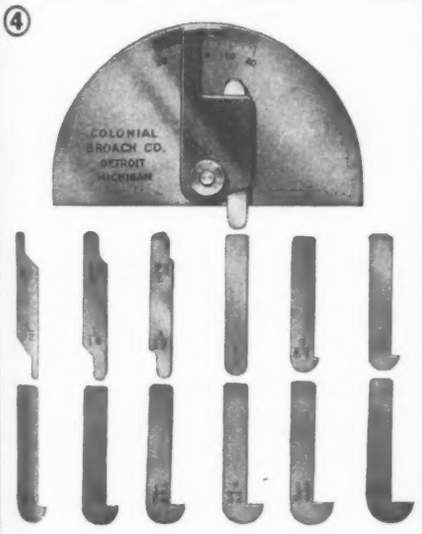
② ILLUSTRATES INCORRECT SHARPENING FORM



③ ILLUSTRATES REGRINDING FOR SALVAGE


Dotted Lines Indicate Stock Removal to Salvage Damaged Cutting Edge
Indicates Shim Used to Bring Cutting Edge to Correct Height

④



How to get more production with your Broaches------

2. BY PROPER SHARPENING

(a) Any marked departure from the original size and form of teeth in resharpening broaches will result in incorrect cutting action. Have the manufacturer supply you with a blueprint for use as a guide.

(b) Always blend the radius of the broach when sharpening teeth. Fig. 1 shows how to successively resharpen a broach.

(c) Don't sharpen a broach in the manner illustrated in Fig. 2. The pockets at the base will prevent chips from clearing the teeth, slow up production and possibly break broach teeth.

(d) Where surface broaches can be adjusted for height, it is permissible to sharpen broaches as shown in Fig. 3. When this is done, care must be taken to maintain proper stepping, backing off and tooth depth.

(e) It is always advisable to check the radius at the bottom of the tooth with simple radius gages as shown in Fig. 4, to keep broaches at peak of efficiency and prevent broach damage from incorrect sharpening.*

(f) Play safe: Don't use makeshift equipment to sharpen broaches.**

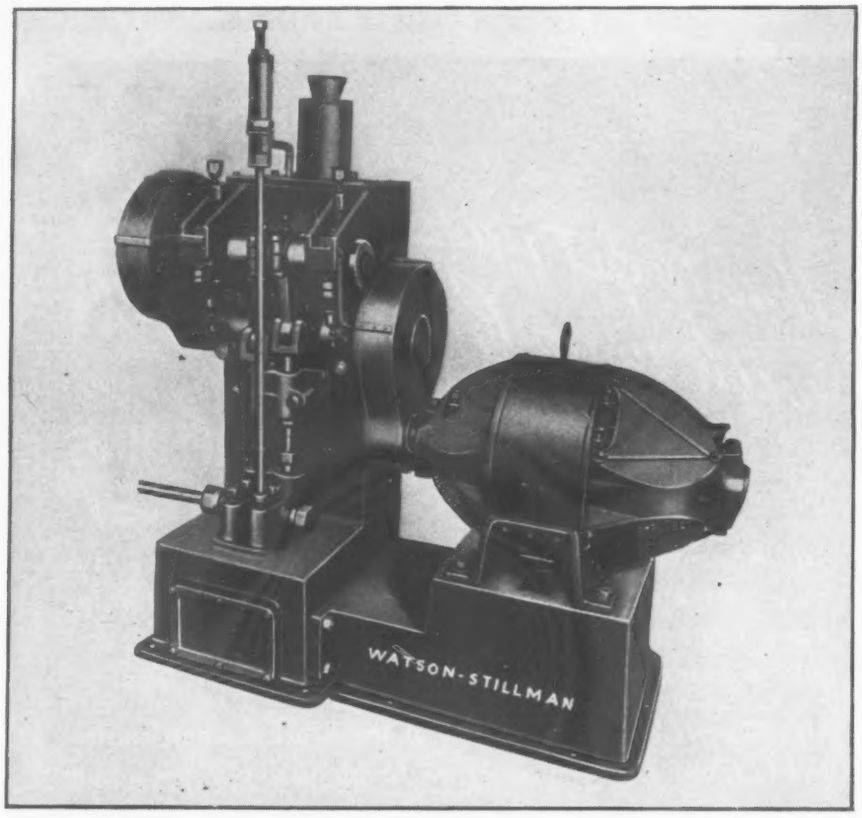
*Available in sets at a nominal price from Colonial.

**Colonial Universal Broach Sharpening Machines are equally adaptable to sharpening of both flat and round broaches.

colonial BROACH COMPANY

Broaching Machines — *Broaches-Broaching Equipment*

DETROIT . . . . . U. S. A.

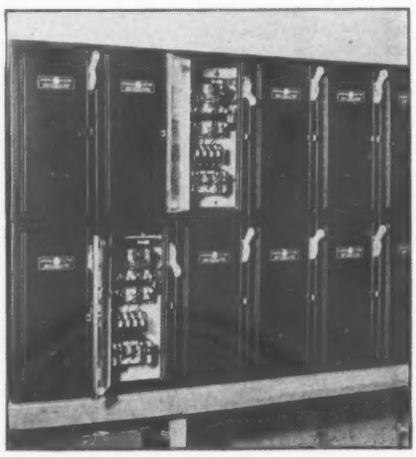


Watson-Stillman Starting Pump Designed For High Pressures

A motor-driven starting pump for high pressures has been developed by Watson-Stillman Co., Roselle, N. J., for primary or auxiliary starting of marine and stationary diesel engines, but also satisfactory for testing or operation of hydraulic presses.

The pump is a two-plunger vertical unit. The ¾ in. dia. plungers have a 1½ in. stroke. It is powered by a 2 hp. motor driving at 720 r.p.m. and develops 4,000 lb. per sq.in. The pump delivers 130 cu.in. per min. at a pump speed of 100 r.p.m. Overall dimensions of the unit are 48×23×48½ in., and weight 1,400 lb.

G. E. Magnetic Motor Starter Combines Switch in One Unit



A line of a.c. combination magnetic starters has been announced by General Electric Co., Schenectady, N. Y., for full voltage starting of induction motors up to 7½ hp. They are available in sizes 0 and 1. To provide greater protection for equipment and operators as well as improvement in appearance the starter and fusible motor circuit switch have been incorporated in one compact unit. The operating handle is projected through the front rather than the side of the case to facilitate mounting groups of starters together.

The motor circuit switch has snap-action contacts of the roller type that easily break stalled motor current. The fuses are held securely in place by Vystipe fuse clips with screw fasteners at each end. The unit is also available with thermal circuit breakers instead of the fusible motor circuit switch.

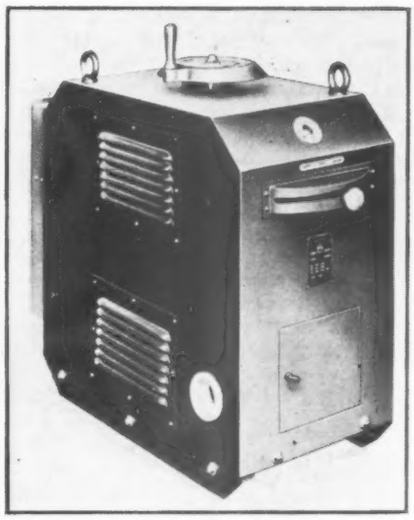
The starters are inclosed in general purpose, cabinet type, all-welded steel cases. The flush type doors close into deep L-shaped flanges, and an interlock prevents opening the door until the switch is off.

Bimetallic overload relays are adjustable for either hand or automatic reset and protect the motor from overheating caused by repeated overloads or too frequent starting.

Glenn-Roberts Manual Welder Has 20-625 Amp. Heat Ranges

A manually operated welder with welding range of 20 to 625 amp. is offered by Glenn-Roberts Co., 1009 Fruitvale Ave., Oakland, Calif., designated as G-R Model 45. This is a heavy duty machine which handles a variety of jobs from light sheet metal work to heavy production work. A specially designed switch provides two ranges of heat, low range from 20 to 200 amp., and high range from 200 to 625 amp. The switch has three positions, off, high and low.

This unit utilizes the G-R principle of flux diversion which permits stepless control at all heats. The input is

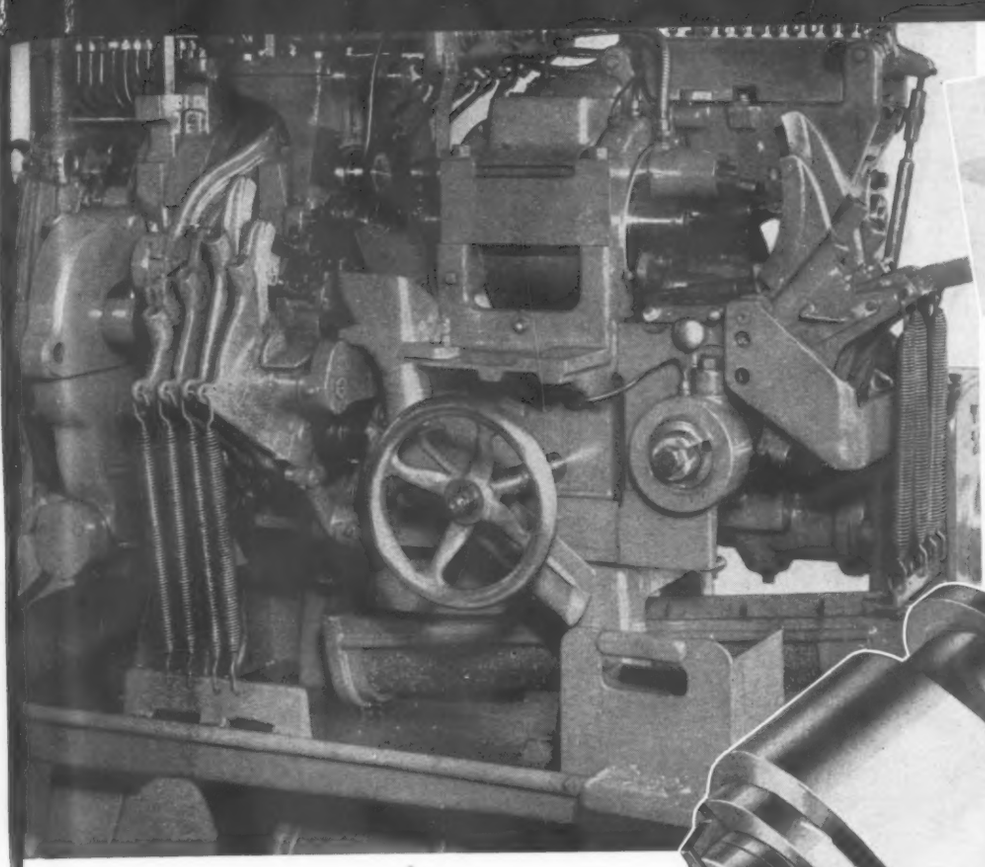


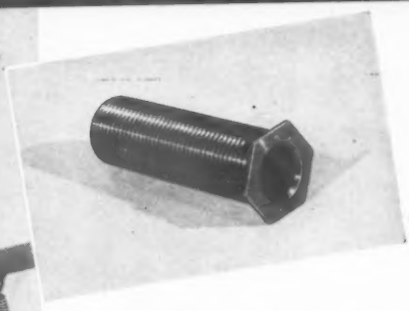
in direct proportion to output, thereby utilizing all energy to the fullest. The transformer core is laminated of die stamped plates of a special low-loss transformer steel. The plates are supported by a heavy steel frame, eliminating noise and tendency to shift. Transformer primaries and secondaries are amply spaced on separate legs of the core, preventing any breakover reaching the operator. Power factor correction is standard equipment, accomplished by oil type capacitors, utilizing non-inflammable oil.

Sauter Contact Making Clock Can Be Used As Impulse Timer

A Type CYC-4 Sauter contact making clock has been announced by R. W. Cramer Co., Inc., Centerbrook, Conn., for application where a.c. of commercial frequency is used in conjunction with maximum demand meters. The clock can be used also as an impulse timer for various time recording instruments. One to twelve impulses per hour are emitted by momentarily closing a circuit at predetermined, fixed time intervals.

Operating pins are inserted into the 60 min. dial at the intervals when an impulse is to be given. The cam serves as a vernier for the dial, the gear ratio





Actual size of the part made on this Davenport Automatic.

The Geometric KD Rotary Die Head used in the set-up.

Below: Close-up of th tooling on the Davenpor Machine, showing th Geometric Die Head.

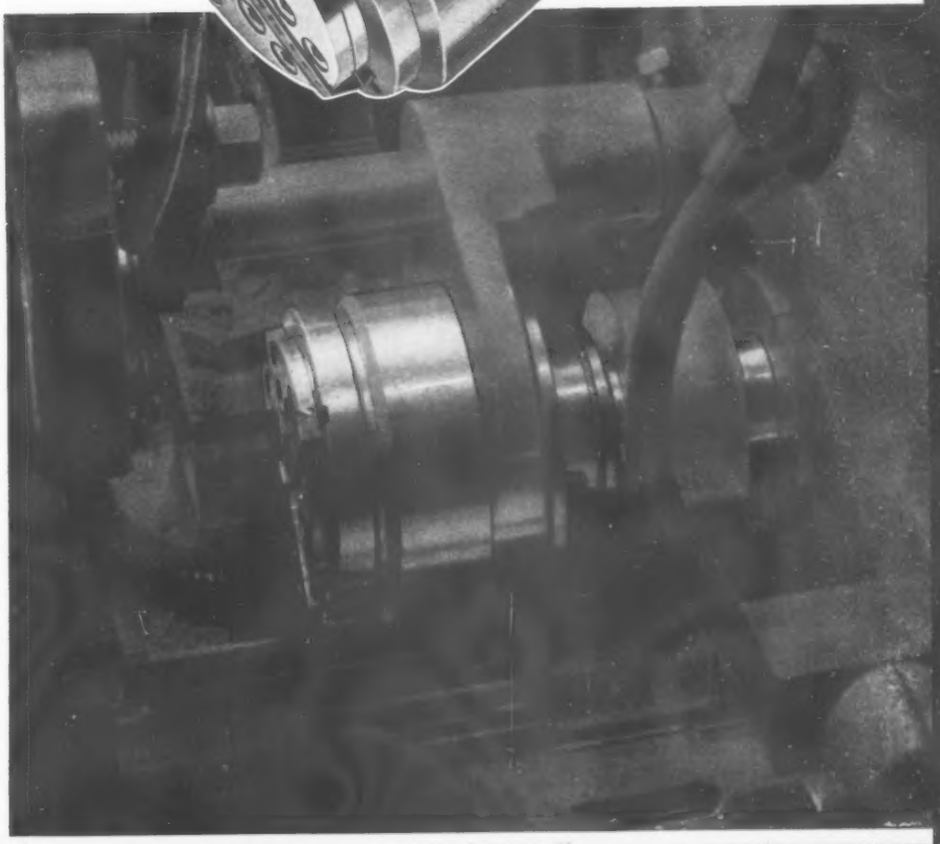
GEOMETRIC DIE HEADS *are used Extensively on* DAVENPORT AUTOMATICS

Davenport Automatic Screw Machine is a high production machine. A GEOMETRIC Die Head high production Tool. It is no wonder, then, that rs of Davenport Machines specify GEOMETRIC Heads and Chasers. These users not only need production qualities but also the Geometric ad- tment feature which permits them to adjust the very quickly.

this particular production set-up, the part is made m 7/16" hex. brass stock. The GEOMETRIC KD tary Die Head cuts a thread, 1-1/4" long in one ond. And notice that the part is threaded within thread from the shoulder.

OMETRIC Dies are removing production "bottle- ks" by keeping pace with production demands. can always depend upon GEOMETRIC.

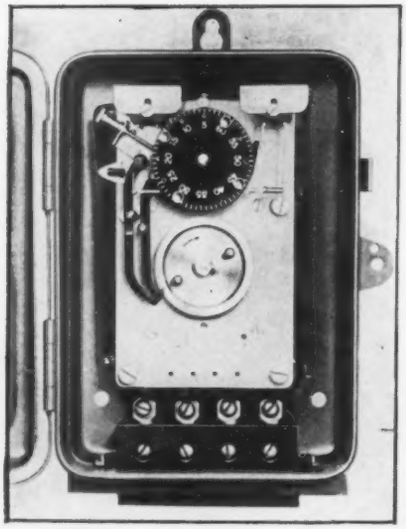
you have a threading problem, get in touch with OMETRIC. Our 40 years experience in making eading tools is available to you whenever you need it.



THE GEOMETRIC TOOL COMPANY

NEW HAVEN, CONN.

GEOMETRIC



being 12 to 1. This cam operates the first contact every five minutes, but as the second contact is wired in series, the actual impulses are emitted only when the operating pins in the dial have closed the second contact. At the intervals selected a short, positive contact is made, the standard setting of which is 1/5 sec.

Mead Midget Assembly Clamp Saves Time in Joining Parts

A midget air clamp for assembly jigs and other multiple applications has been introduced by Mead Specialties Co., Dept. M-19, 15 South Market St., Chicago, Ill. While designed especially for the aircraft industry, it is useful in many other industries involving the joining by welding, riveting or bolting of two or more component parts of any assembly.

All air clamps in any set-up can be operated by a single master valve. The locking and releasing of assemblies is instantaneous. Any desired group of clamps can be controlled independently of any other group. The clamp ram holds with equal pressure at any point along its stroke, making special delicate adjustments unnecessary.

The compact size of the unit permits installation in cramped corners. By use of the midget air clamp actuated by foot control valve the operator's hands are free to handle the work pieces. It delivers 80 lb. pressure on a line pressure of 100 lb. The stroke of the ram is ⅝ in. An internal return spring withdraws the ram when air is exhausted from the cylinder by the control valve.

Production Devices Introduces Airlox Junior Pneumatic Vise

A junior model, Colt type, Airlox vise for milling, drilling, tapping, filing and bench assembly operations has been brought out by Production Devices Inc., Main St., Poultney, Vt. The vise is powered by a special air cylinder and constructed so that the cylinder and mechanism are inclosed inside

(*Continued on page* 1400)

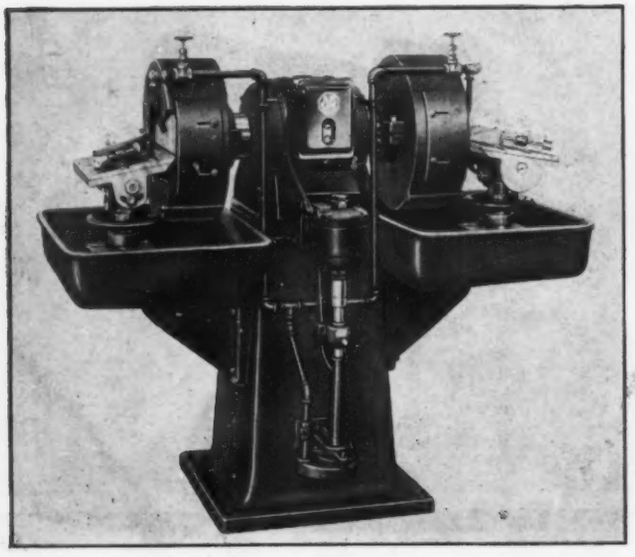
J. G. Blount Wet Grinder Suited for All Tool Angles

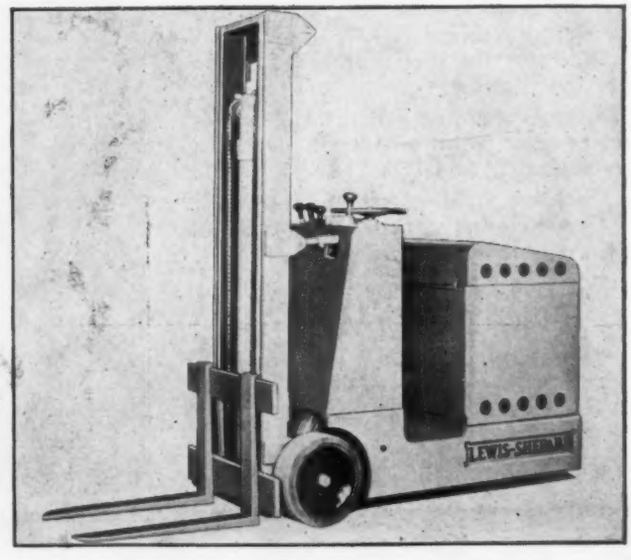
A Model T C wet grinder has been introduced by J. G. Blount Co., Everett, Mass., which is equipped with adjustable graduated tables. The machine is suited for grinding all possible angles and clearances on tools.

The coolant tank and removable sludge pan are built in the column, and a vertical motor driven centrifugal coolant pump is provided. The base of the column measures 23×24 in., and height from the base to the center of the spindle is 37½ in. The table top is 9½×11½ in. Each top is adjustable and is equipped with a protractor guide. Grinder weighs 1,572 lb.

Lewis-Shepard Fork Lift Truck Built For 3,000 Lb. Capacity

Lewis-Shepard Sales Corp., 123 Walnut St., Watertown, Mass., is offering a tilting fork type, telescopic and non-telescopic, industrial lift truck with 3,000 lb. capacity, gas or electric powered. It is compact and low-slung with a low gravity center and pivots practically in its own length, of one-piece, extra-heavy construction with reinforced main frame casting. The truck is designed to stack two, three and four high pallet loads, bales, loose-bagged materials, tote boxes, skids and strapped cartons. The simple, straight-line, controls are easily operated by finger motion levers. Traction wheel brakes are of the constantly applied type and release by foot pedal. The truck is provided with quickly detachable forks furnished in various types and sizes to suit requirements. It has a lift speed of 18 ft. per min. full load and a lowering speed of 40 ft. per min. full load. Hoisting is accomplished by means of hydraulic power supplied by a pump direct connected to a wound motor and controlled by a hand lever.





RIGIDHOBBER

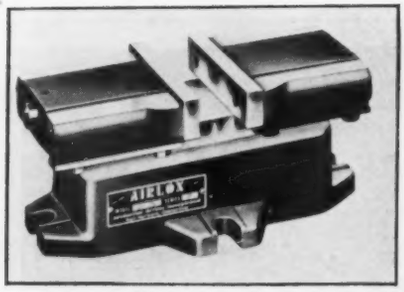
SPECIFICATIONS FOR RIGIDHOBBER 3616

Maximum Diameter Spur Gears	36"
Maximum Diameter Helical Gears	27"
Min. Center Line Work & Hob Arbors	3"
Maximum Hob Diameter	8"
Diameter Work Table	24"
Diameter Index Gear	26"
Rated Max. Dia. Pitch	3"
Floor Space, inc. door swing	54" x 160"
Weight	18,000#

36" DIAMETER 16" TRAVEL 20" LONG

Write! FOR FURTHER INFORMATION

THE CLEVELAND HOBBING MACHINE CO.
CLEVELAND · OHIO



the vise body. This tool may be fastened across or lengthwise on the milling table. Machine surfaces on top of the vise jaws permit the attachment of any special fixtures. Maximum gripping pressure can be obtained during the last 1/16 in. of jaw travel by screw adjustment of the stationary jaw. Bolts can be adjusted to lock the jaw firmly in place.

The overall length of the Airlox vise is 10 in., width 5⅞ in., height 4½ in. The jaw has a depth of 1⅛ in. and width of 4¾ in. The usable jaw opening is 2⅛ in. between the jaw faces, 3 in. between the jaw castings. The weight is approximately 25 lb.

Acromark Nut Marking Machine Has Interchangeable Mandrel

A nut marking machine has been introduced by Acromark Corp., 9–13 Morrell St., Elizabeth, N. J. The machine is a standard foot press with a special mandrel and guide arrangement to receive the nut. Interchangeable steel stamping type is held in the ram of the press by a Hercules type holder.

The nut is slid onto the hardened projecting mandrel and the adjustable guides at each side position it so that a flat side faces upward to receive the mark. The mark is quickly impressed by a swing of the foot lever.

Different sizes of interchangeable mandrels can be furnished to take a variety of nut sizes. Since the mandrel surface touches the entire face of thread surface, the nuts can usually be marked after threading.

Roller-Smith Makes Balances In Single or Double Hook Type

Two new models of precision balances have been developed by Roller-Smith Co., Bethlehem, Pa., the Model B-1 available in the double hook type, and the Model B balance available in either single or double hook type. In the MB type the balance is provided with a weighing chamber to protect the hook and weighing sample from drafts.

The material to be weighed on the single hook balance is hung on the

(*Continued on page* 1402)

Stearns Magnetic Log Washer Treats Abrasives in Wet State

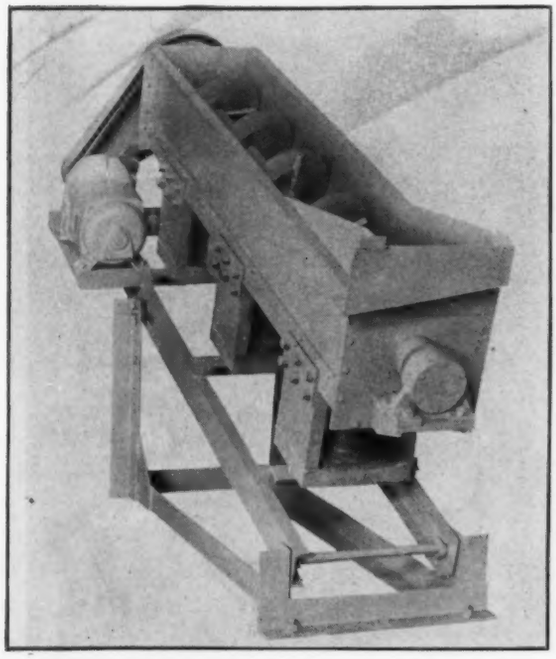
For treating fine abrasive and similar materials in the wet state an improved type of magnetic log washer has been brought out by Stearns Magnetic Manufacturing Co., Milwaukee, Wis. This washer consists of a single ribbon type screw conveyor operating at 30 to 32 r.p.m. on a slope. It is equipped with adjustable frame supports over the magnetic field and is driven by a gear reduction motor through guarded variable pitch V-belts and sheave.

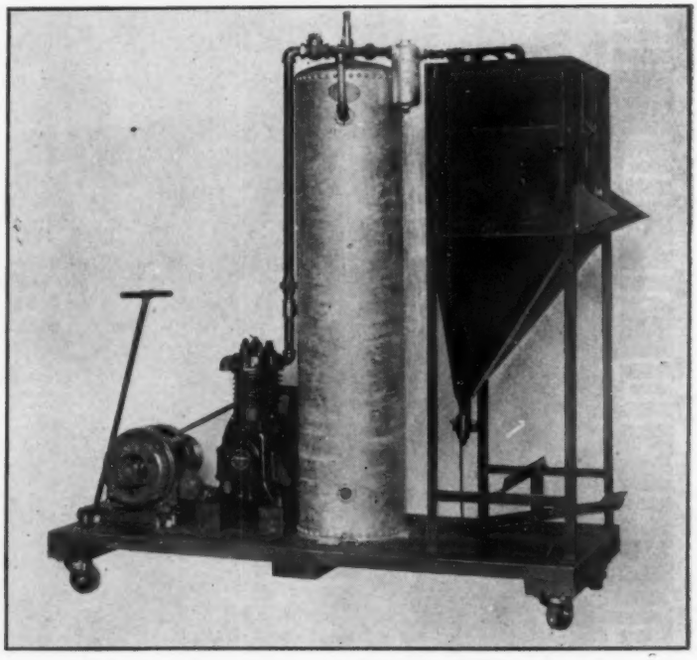
The material is fed into the washer trough and tailings are discharged at the lower end and the concentrates at the top. The magnetic flux of the coil is controlled by rheostats, giving maximum flexibility in adjusting the strength of the magnetic fields to the type of material which is being treated.

The washer operates from direct current up to 300 volts, or from motor generator sets where d.c. is not available. The dimensions of this unit are 7½ ft. overall, 25 in. wide with a maximum width of 44 in. The unit is about 4½ ft. high.

Leiman Sand Blasting Outfit Takes Hand, Automatic Feeding

Introduction of a cabinet sand blast outfit of the self-feeding variety has been made by Leiman Bros., Inc. GW-136 Christie St., Newark, N. J. While the equipment can be used on most materials including metals, wood, glass, plastics of almost any shape or size, there are variations available to do the work holding the articles by hand or feeding them automatically into the machine for production at any speed desired.





THE HAND IN YOUR PLANT THAT STEEL WORKERS WANT TO SHAKE

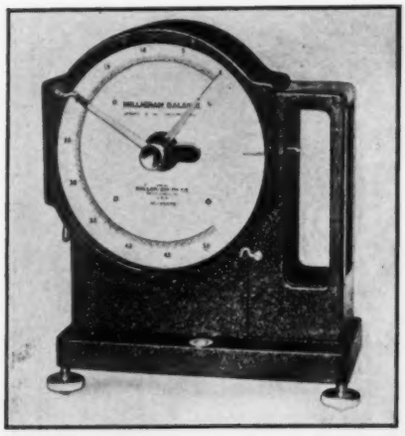
— is the hand that chalks "scrap this" on every obsolete machine—on every piece of idle equipment, and starts them on their way to the steel furnaces to be made into fighting steel. Appoint some one in your plant—with knowledge and authority—to scrap every old-time machine and every piece of equipment not working for you *now.* This scrap is needed for making high quality steels for shells, bombs, guns, tanks, planes, and ships.

JONES & LAUGHLIN STEEL CORPORATION

PITTSBURGH, PENNSYLVANIA

PARTNER TO INDUSTRY IN WAR PRODUCTION

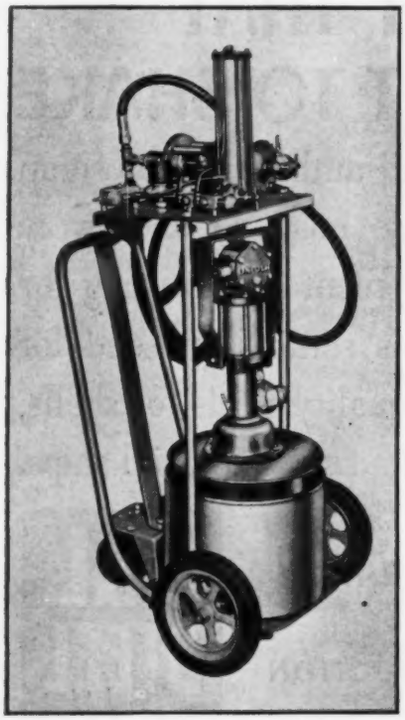
J&L STEEL



hook and the index lever moved until the parallel pointer fastened to the beam indicates zero. The index pointer attached to the index lever then indicates the weight of the object. In the double hook model the second hook is provided so that counterweights can be used to increase the capacity of the balance to a maximum of three times normal.

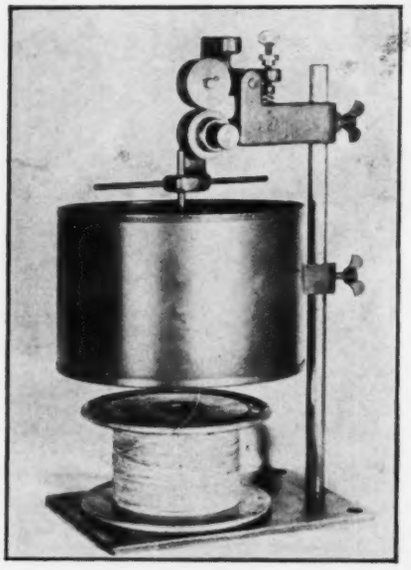
Lincoln Portable Model Pump Has Forced-Induction Priming

Announcement of a portable forced-induction pump, 50 Series, has been made by Lincoln Engineering Co., 5701 Natural Bridge Ave., St. Louis, Mo., which is mounted on wheels for moving from one location to another. Materials such as sealing compounds, sound deadeners, heavy lubricants, insulating materials and viscous grease can be pumped directly from the original container to the point of application with this pile driver, which embodies a revolutionary principle of pump design.



Uni-Flo Fine Wire De-Reeler Is Made In Two Spool Sizes

For de-reeling wire from supply spools the Globe Tool & Engineering Co., 436 Davis Ave., Dayton, Ohio, has brought out a Uni-Flo de-reeler in two sizes, the No. 1 for 3 in., and the No. 2 for 4 to 6 in. sized spools, recommended for wire sizes of from No. 26 to 42 gage. The unit operates at high speed



with uniform tension, free from kinks and broken wire. It handles stretched or hardened wire. It is quickly adjustable from one wire size or application to another.

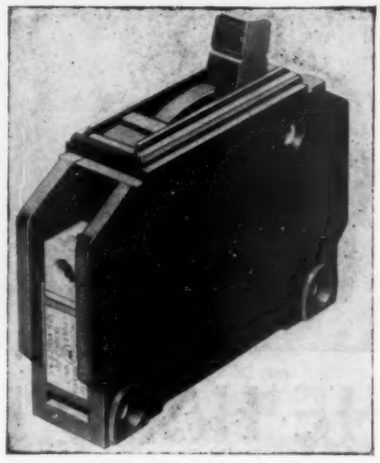
Executone Communication System Features Interceptor Control

Executone, Inc., 415 Lexington Ave., New York, N. Y., has introduced an improved executive-monitor communication system which consists of two or more master stations connecting up to 19 remote stations in the system. The executive and monitor stations can talk to each other, or either one can carry on two-way amplified voice conversations with remote desk or trumpet type substations in outlying departments. The interceptor control feature enables all incoming calls originating at the remote stations to be intercepted at the monitor station.

Busy signals which illuminate to show when other stations are in use are provided at both the executive and monitor stations. A paging button enables the user of any master station to call all other stations simultaneously. Persons called can reply remotely without leaving their work to approach the station. High powered trumpet type substations give extra sound volume to cover large space areas or penetrate high noise levels. Pushbutton selection facilitates speed of operation. Power consumption for the entire system is 46 watts and electric connection is to 110-120 volts a.c. or d.c. current.

Westinghouse Quicklag Breaker Offers Faster Opening Action

Quicklag De-ion no-fuze breaker is offered by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for lighting and appliance circuits. This breaker combines in a single unit a cooperative thermal-magnetic trip action, and affords faster opening action on short circuits and full time delay on overloads. It is available in ratings



of 15, 20, 25 and 35 amp., single pole only, 125 volts a.c.

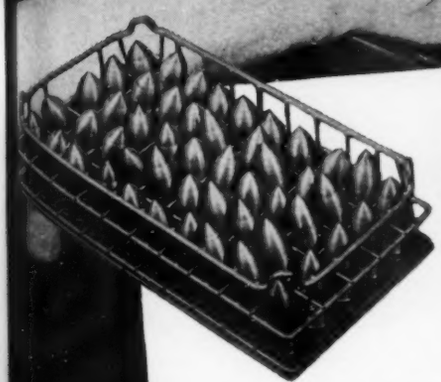
This 6 oz. unit has been designed to give practical circuit protection for all kinds of lighting, appliance and fractional motors, and portable tools and appliances using small wire sizes. It is claimed that the breaker will stop a force equivalent to 230 hp.

American Pulley Hand Truck Has Sliding Hook for Loading

A new addition to the line of hand trucks made by American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa., is the UPSY drum loading truck, suitable for any container having a chime or bead. It handles up to 1,000 lb. and loads a drum without the necessity of moving it away from adjacent drums.

A sliding hook on the center rail of the truck catches the top bead of the container. The operator pulls down on the handles and tilts the

A.P. SHELLS-260 MORE PER TOOL GRIND"



SUNICUT 209

"BOOSTS 37MM. SHELL PRODUCTION"

Production of 37mm. armor-piercing shells at this metal-working plant was hindered by short tool life . . . until a Sun Doctor of Industry diagnosed the trouble and recommended a change in cutting fluid — to Sunicut 209.

On the circular forming operation Sunicut 209 increased tool life by more than five times! On other operations it likewise effected a substantial improvement.

Another advantage of Sunicut 209 that operators were quick to appreciate was its transparency — permitting a clear view of tools and work at all times, easy micrometer readings, greater accuracy, fewer rejects.

Sun Engineers and Sunicut have been rendering production-boosting service like this since long before Pearl Harbor. Today . . . in your own plant . . . whatever your metal-working problem . . . they can help you. For helpful examples of how they are helping others, write for your copy of the booklet "Helping Industry Help America."

SUN OIL COMPANY · Philadelphia

Sun Oil Company, Ltd., Toronto

WAR BONDS
ND STAMPS

SUNOCO

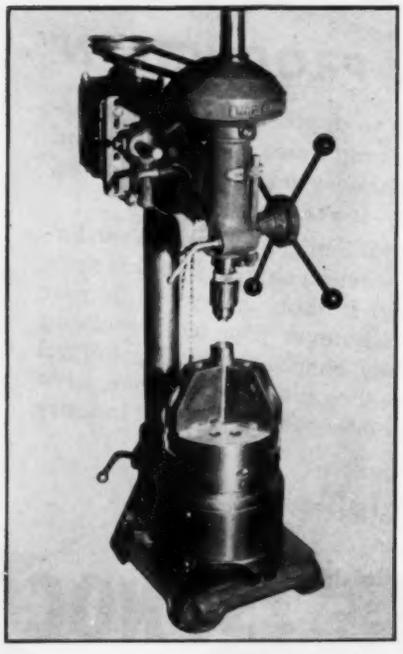
UN PETROLEUM PRODUCTS HELPING INDUSTRY HELP AMERICA

drum toward him. The nose prongs slide under the bottom bead, and as the truck handles are lowered to trucking position the prong lifts the unit off the floor. The range of the hook is from 16 to 40 in.

37 to 105 mm. Shell Machined With Anker-Holth Universal Chuck

A combination air cylinder and air operated, three-jaw, universal chuck produced by Anker-Holth Manufacturing Co., McCormick Bldg., Chicago, Ill. Universal has been adapted for use on a drill press in performing all internal machining operations on 37 mm. to and including 105 mm. high-explosive shell.

These combination chucks are made in cylinder sizes from 6 in. to 15 in., for air pressure up to 100 lb. The total jaw travel for the 6, 8, 10 and 12 in. sizes is ¾ in., and 1 in. for the 15 in. size. Jaw pressures range up to 75,000 lb. Operation of the chuck is by either foot or hand valve. It will grip internally or externally.



Ruthman Gusher Coolant Pump Has Interchangeable Mounting

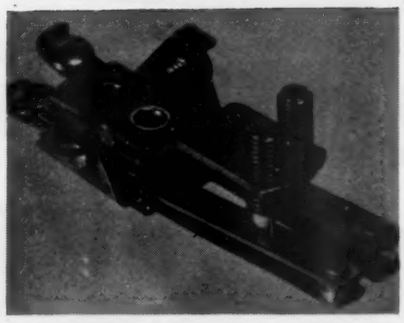
A Model 5-P3 vertical gusher coolant pump has been developed by Ruthman Machinery Co., Cincinnati, Ohio, with 1/10 hp. motor and a capacity of 10 gal. per min. The discharge relation is available either right or left hand. Driving motor is a full ball bearing type with one-piece suspended shaft to the pump housing.

The impeller housing and mounting flange are cast in one piece. This flange is larger so as to be interchangeable with larger size gusher pumps. The impeller is the twin equalized intake type which accomplishes hydrostatic balance, also automatically cleans out the intake chambers when the discharge line is throttled. This acts as an automatic bypass which prevents building up pressure.

Ulanet Duplex Thermostat Adjustable to Three Contacts

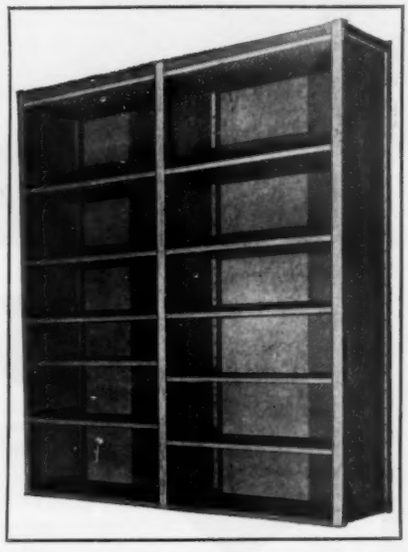
Introduction of the DSK series duplex thermostat has been made by George Ulanet Co., 92 East Kinney St., Newark, N. J. The unit has three contact combinations, normally closed contacts on both thermal elements, normally open on both, and normally open contacts on one element and normally closed on the other. It measures 2⅝ × 1 1/16 × ¾ in. and is easily mounted with two screws through the eyelets.

The thermostat can be connected as two single pole single throw switches, or as one single pole double throw switch. Recommended electrical rating is 500 watts non-inductive load at 115 to 230 volts a.c. Each thermostatic element is independently adjusted by its respective adjusting screw provided on the mounting bracket. Temperature ranges of the unit are 300, 450 and 700 F.



Wood Used in Lyon Shelving Replaces Former Steel Product

Replacement of steel shelving by the use of wood in the construction of this product has been made by Lyon Metal Products, Inc., 3011 Clark St., Aurora, Ill. The shelving is made in the open and closed types. The top, base, shelves, braces, arms and uprights are made of solid hard wood. The side panels and back panels on the closed type are ¼ in. plywood. The shelving is finished with a green tinted preservative coating that reduces moisture absorption. Features include dividers, bin fronts, shelf boxes and adjustable shelves. Sections are 36 in. wide and 84 and 96 in. high, and may be secured in 12, 18 or 24 in. depth.



Willson Builds Dust Respirator With Special Breathing Valves

Willson Products, Inc., 251 Thorn St., Reading Pa., has introduced the No. 10 light weight dust respirator. Specially designed inhalation and exhalation valves provide breathing freedom. The face piece can be easily adjusted to

AN AUTOMATIC CYCLE for Your Job!

The full range of automatic cycles shown are standard and each cycle is obtainable front or rear. The front and rear cycles can be used simultaneously or independently and require no cams or special attachments.

FEED
POWER TRAVERSE RETURN
POWER TRAVERSE FORWARD
START
NOTE: STANDARD FOR FRONT ONLY. CAN BE FURNISHED FOR REAR AS EXTRA.
SET ANGLE TO SUIT WORK

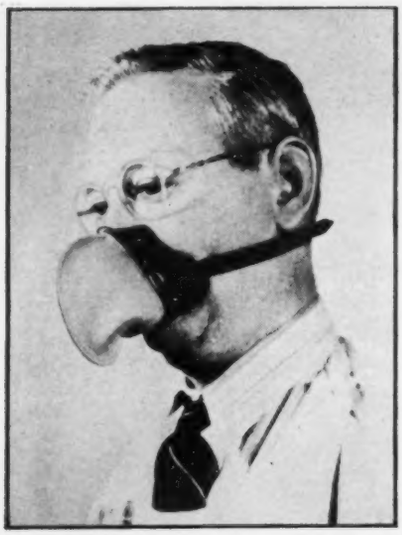
Awarded Navy "E" March 6, 1942

Write for Bulletin 601 . . . on the unusual features of The 3A Duomatic

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

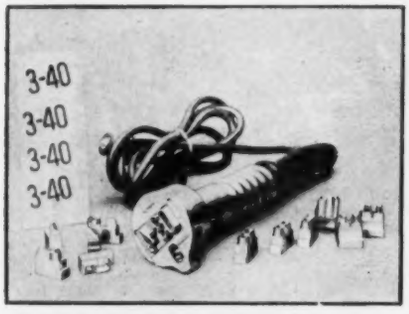
ENGINE TOOL ROOM AUTOMATIC LATHES



fit the contour of the wearer's face, and is particularly adaptable for use by women. The headband is elastic. The respirator is said to be practical for long periods of time without impairing the worker's efficiency.

Acromark Electric Brander Marks Plastic, Wood, Fabric

Materials of plastic, wood, fiber and fabric can be marked with the hand electric brander No. 40 announced by Acromark Corp., 9-13 Morrell St., Elizabeth, N. J. It plugs into an electric light socket. Letters or figures can be inter-

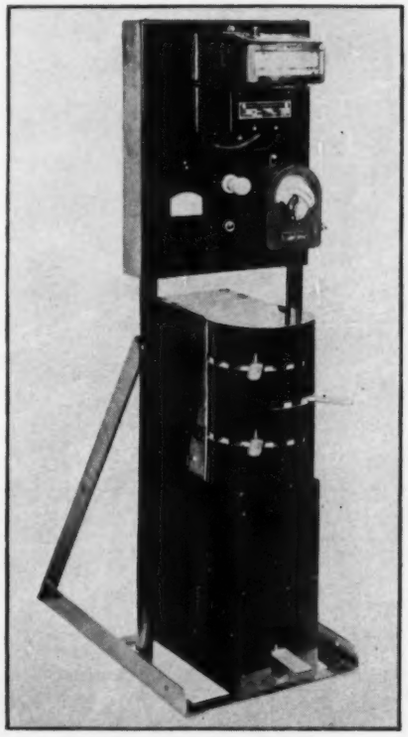


changed in the holder and interchangeable dies can be substituted for branding names and trade marks. The tool is also adaptable for several other marking purposes, and is made in several sizes to suit various marking requirements. The type and dies are made of a brass or bronze alloy for some branding purposes, and for others steel is used.

Upton Temperature Control Measures Heat for Salt Baths

For salt bath heat-treating a temperature control has been announced by Upton Electric Furnace Div., 7450 Melville Ave., Detroit, Mich., which measures and adds the correct amount of power for the proper interval and corrects the operator for any error on his part in setting the control. It is claimed to be foolproof and to eliminate much, if not all, finish grinding on many high-speed steel cutting tools by permitting prediction of size change to closer limits.

This control keeps the heat on at all times, but at a low value. When the work is put into the bath, it adds a definite amount of heat for a specific interval, and when the interval is ended it reduces the power back to a holding level and warns the operator that the work should be removed. The controller warns the operator if he

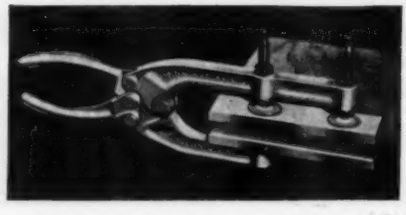


has made an error in settings, should it be as little as 3 F.

The equipment consists of a panel stand on which the pyrometer, timer, ammeter and signal light are mounted. Below the panel is a cabinet with three heat selector levers. To avoid burning the contact points of the hand lever switches when a change in heat selection is being made a foot-operated circuit interlock is provided. The control and stand occupy a floor space of 8 sq.ft. and can be placed for the operator's convenience.

Knu-Vise Clamping Plier Distributes Uniform Pressure

A parallel clamping plier has been introduced by Knu-Vise, Inc., 16981 Hamilton Ave., Detroit, Mich. The extended parallel jaws with two spindles cause the pressure to be distributed more uniformly over a greater area. The plier has been found particularly useful in gluing plywood in building gliders and training planes.



McDonald Dustfoe Respirator Protects Against All Dusts

A Clear Vue Dustfoe respirator announced by B. F. McDonald Co., 1248 South Hope St., Los Angeles, Calif., is made of transparent plastic which may be easily washed and sterilized. Both the facepiece and filter housing consists of this material, which enables the operator to make a visual check of the filter while the device is in use. The facepiece readily conforms to any facial contour, and employs the army gas mask type exhalation valve for low breathing resistance.

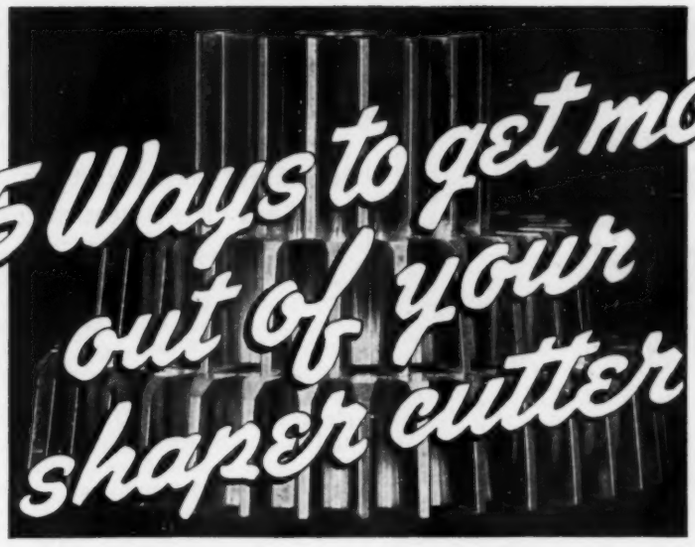
The respirator affords protection against pneumoconiosis-producing dusts and mists, or for all dusts including lead duct, and it may be worn comfortably with goggles or spectacles. All parts of this device are replaceable.

Sticht Speed Indicator Available in Two Ranges

Announcement of a Model DS chronometric tachometer or speed indicator, available in two ranges, has been made by Herman H. Sticht Co., Inc., 27 Park Place, New York, N. Y., for measuring revolutions per minute and feet per minute. On one type the large hand equals 100 r.p.m., or 50 ft. per min., and one revolution of the small hand equals 1,000 r.p.m. This instrument can be used for speeds up to 2,000 r.p.m. and is suitable for slow-running machinery.

On the other type each division of the large dial represents 1,000 r.p.m., and one revolution of the small hand equals 10,000 r.p.m. and can be used for speeds up to 20,000 r.p.m. This style is suited for testing the speeds of motors, particularly fractional horsepower, generators, fans, and the like.

The hands of the indicator remain



CORRECT SET-UP

The accuracy of a shaper cutter is no better than the accuracy with which it is mounted in the machine.

1. Be sure there is no play between shaper cutter and arbor.

2. Check concentricity with an indicator graduated to ten-thousandths. Maximum runout should not exceed 0.0005.

3. If runout exceeds 0.0005 in., unclamp and rotate the spacing collar—these collars usually having slight errors in parallelism.

4. Helix errors in tooth surfaces may be due to wear in ways guiding the spindle in the helical path.

5. When clamping the cutter in position, use the minimum number of spacing collars possible.

Additional helpful information is available in a booklet on gear shaping and shaper cutters. Ask for Bulletin GS-42.

SHARPENING

A sharp cutter will cut faster with less power and wear. It will produce more accurate work with better finish.

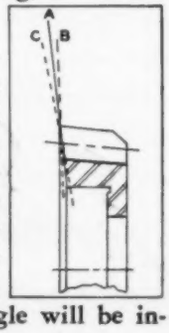
1. Use a soft wheel with medium grain. Keep wheel clean as a glazed wheel may crack cutter teeth.

2. Grinding too much metal at a time may cause heat-checks in the cutter teeth.

3. Never grind a cutter except on its face. "Touching up" sides or ends will alter the tooth form and spoil the cutter.

4. Be sure the cutting face is true with the bore. If not, cutting action will be irregular and tooth form changed.

5. Always grind to the correct face angle ("A" in drawing) as marked on the cutter.



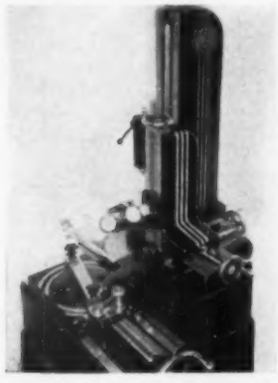
If the angle is decreased ("B") the pressure angle will be changed and cutting efficiency decreased. If the angle is increased ("C") the cutting efficiency may be increased but the pressure angle will be incorrect.

CHECKING

Gear checking equipment should be such as to disclose the *exact nature* of the inaccuracy producing unsatisfactory gears.

1. Incorrect pitch diameter usually means machine-setting error or heat-treat distortion. Check with pins or balls.

2. Variable backlash is usually due to eccentricity. Use a master gear in preference to an indicator, if possible. Also check cutters and their mounting for eccentricity.

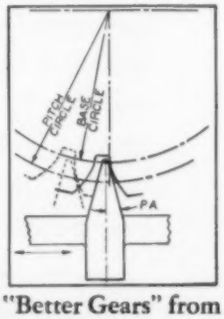


Michigan Sine-Line Lead Checker

3. Tooth form and spacing should be checked together, since the former is not dependent on depth at which measurement is taken.

Michigan Sine-Line Involute Checker

4. Check the spiral lead rather than the helix angle, since the former is not dependent on depth at which measurement is taken.



Master Rack Tooth Simplifies Checking

5. Get a copy of "Better Gears" from Michigan Tool Company for detailed information on locating gear troubles.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS ROAD . . . DETROIT, U. S. A.

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UNIVERSAL INDICATOR

EASY TO READ IN ANY POSITION. TWO READING FACES

If you are setting up or checking jobs then you'll certainly appreciate the advantages of a Lufkin Universal Indicator. Built in one unit it makes a complete revolution on its own center. Readings can be taken from either the flat or top side of the face and in any position. Especially suited for jig boring, milling machine and drill press work. Attachments are furnished for use in drill chucks, surface gages or with a Vernier Height Gage. With this indicator there's no need to use a mirror, or to get in an awkward position for use. For complete information on Lufkin Tools write for free catalog.

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at rest at the reading reached during the test and, therefore, may be read at leisure. Resetting occurs automatically when the pushbutton is pressed in for the next test.

Acme Sheet Metal Layout Dye Gives Clear Dimension Reading

A layout dye or coating for application to flat sheet metal to permit easy reading of dimensions, reference points and the like has been produced by the Acme White Lead and Color Works, 8250 St. Aubin Ave., Detroit, Mich. This is semi-transparent, purple in color, is brushed on the surface and said to be extremely quick drying. The layout is scribed on the stock with a sharp-pointed stylus, nail or similar tool, and the layout stands out clear and bright because the metal shows through the dye.

Denatured alcohol is used to wash the dye off when the sheet metal work has been completed. In many cases, however, the film of layout dye is so thin that there is no need to remove it. The dye is available in quart or gallon containers.

Sylvania Slide-Grip Hangers Have Five Mounting Methods

Slide-grip hangers have been developed for all continuous-row industrial fluorescent fixtures made by Sylvania Electric Products Inc., Lighting Div., Ipswich, Mass. They are flexible and offer a variety of applications for chain, surface, rod or messenger cable mounting. The hangers are mounted first, after which the fixtures are simply lifted section by section and snapped into place in the vise-like hanger then tightened by a through-bolt that acts as a safety device. Holes are provided in the hangers for chain and S-hook mountings or for single rod suspension or cable clamp. These hangers are adaptable to five different mounting methods.

Acme 100-25 Lamp Ballast Holds Four Fluorescent Lamps

A Model F 100-25 lamp ballast for four 100 watt fluorescent lamps has been announced by Acme Electric & Mfg. Co., Cuba, N. Y. The design provides equalized and balanced secondary voltage to each lamp, and the core and coil elements of the fixture are said to be impregnated and compounded to minimize normal resonant vibration.

Wall-Colmonoy Corp. Alloy Tips Metal Cutting Tools

Four grades of Colmonoy WCR alloy for tipping metal cutting tools have been made available by Wall-Colmonoy Corp., Fisher Bldg., Detroit, Mich. A stiff carbon steel shank or tool body is recommended in fabricating a new

tool in order to properly support the hard metal tip. To eliminate excessive grinding on the base metal after WCR alloy has been applied it is desirable to cut the tool blanks to slightly greater clearances and angles before it is welded on. In rebuilding broken or worn high speed steel tools the same general procedure is followed except that in most cases whole cutter teeth and flutes have to be built up with WCR alloy. A soft flame is used for melting, and the alloy can be shaped within a plastic range of 400 F. varying with the grade.

All grades of this metal can be hot wiped after building up to minimize grinding time. The alloy is supplied in welding rod form, sizes ⅛, 3/16 and ¼ in.

NEW MATERIALS

Hanson-Van Winkle-Munning Makes Adhesive For Coarse Abrasives

An adhesive has been developed by Hanson-Van Winkle-Munning Co., Matawan, N. J., which serves as a substitute for glue in facing polishing wheels. It is simply heated, and as soon as warm it is ready for use. This adhesive is suitable for coarse abrasives such as No. 60 grain. For finer grain sizes water in proportion as needed is added. Material that is unused may be reheated without waste.

Du Pont Develops Rayon Tow For Use As Packing Material

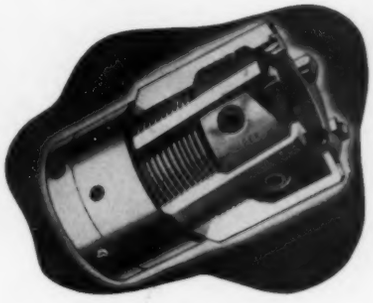
Rayon rope has been developed by E. I. du Pont de Nemours & Co., Wilmington, Del., for use as mechanical packing material to seal against escape or entrance of water, brine, oil and other fluids. The product consists of an untwisted rope made of many thousands of continuous filaments of viscose rayon and is known as Type 126 rayon tow. It is furnished in braided form and impregnated with lubricants. Usually the finished packing is square in cross-section and is installed in the stuffing box in a spiral coil.

Konag Cutting Oil and Jelly Used for Tough and Soft Metals

Konag transparent cutting oil has been announced by National Graphite Co., Inc., 17 John St., New York, N. Y., for severe cutting operations on tough steels and alloys. It is a straight mineral-sulphurized-degummed, transparent oil, and is free flowing to quickly remove chips and grindings from the cutting, provides faster heat dissipation and helps attain higher cutting speeds. It is said to have no objectionable odor and will not become rancid or thicken in service, and can be used over again.

The company has also developed a

TO USERS OF McCROSKY SUPER REAMERS



Now is the Time for All Good Tools to Receive Good Care

AMERICAN INDUSTRY has to make the most of what it has these days—and make that most go a long way. This applies to any given equipment in any given plant, but we're thinking particularly about McCrosky Super Reamers and you machinists who use them.

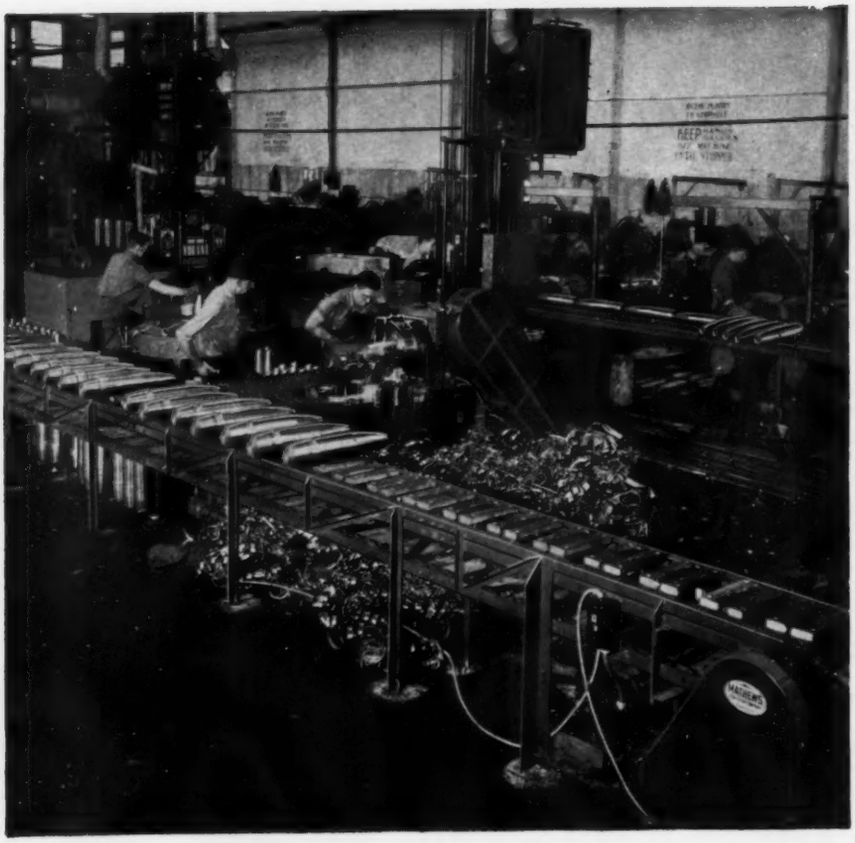
Built to give long, dependable service, McCrosky Super Reamers are proving equal to the emergency right up where the going is toughest on the war production front. And for the sake of your production and our war, we want to make sure that those war production "weapons" have the best possible care and servicing.

So we have prepared a brief, illustrated manual about the fundamentals of reamer grinding and maintenance. Write for the McCrosky Reamer Manual now. It will help insure the maximum efficiency and long life of your weapon.

E.S.T. 1904
McCROSKY TOOL CORPORATION
MEADVILLE, PA.

WRITE NOW FOR

McCROSKY REAMER MANUAL



SHELL PLANTS DEPEND ON

MATHEWS

Conveyers

● Mathews engineering hours are reserved these days for manufacturers of war materials. Makers of munitions in the United States and Canada are watching production figures rise — assisted by Mathews Conveyer Systems. Perhaps you've overlooked an opportunity to "Keep 'em Rolling" faster by not taking advantage of the experience of your Mathews Engineer. If you have, a wire or a letter will bring complete information as to how Mathews can best serve you.

MATHEWS CONVEYER COMPANY

ELLWOOD CITY, PENNA.

Field Engineers and Sales Offices located in 30 Industrial Centers

DOUBLED CAPACITY FOR WAR PRODUCTION

Stepping up our productive capacity month after month has barely enabled us to keep pace with mounting war orders As long as this condition exists, it becomes increasingly difficult to meet civilian requirements. Our one big job is the handling of war material. That job must come first.

colorless water soluble castor oil jelly for lubrication at the cutting edge in automatic screw machine work and high speed operations on softer metals and shallow cuts. The jelly is soluble in water, non-corrosive, sudless and free from sediment and does not produce smoke or smell.

Both products are said to avoid oil dermatitis infection. They are furnished in 5 and 55 gal. steel drums.

Ever Ready Makes Gumming That Will Stick to Metal

A stick-to-metal gumming has been introduced by the Ever Ready Label Corp., 141 East 25 St., New York, N. Y., which can be applied to either paper or linen fabric, upon which any message can be written or printed and then placed on metal surfaces.

Synthetex Hot Oil Coating Salvages Defective Castings

For salvaging defective castings Protective Coatings Inc., Box 56-AM, Strathmoor Sta., Detroit, Mich., has introduced Synthetex Type 40 hot oil coating, which also seals castings and prevents oil penetration. The material coats interior hot oil pressure areas, prevents sand and metal particles from damaging pistons, cylinders and other moving parts.

TRADE PUBLICATIONS

ABRASIVE BLAST CLEANING A comprehensive illustrated manual on the care and operation of Wheelabrator airless abrasive blast cleaning equipment has been published by American Foundry Equipment Co., 555 S. Byrkit St., Mishawaka, Ind.

BARREL PUMP Engineering Bulletin No. 425, prepared by Trabon Engineering Corp., Cleveland, Ohio, contains sectional views and describes electric-hydraulic pumps for pumping oil, light medium or heavy greases directly from the original container.

BEARINGS "Steel Mill Data for Calculation and Design," an 88-page reference volume compiled by SKF Industries, Inc., Front St. and Erie Ave., Philadelphia, Pa., contains formulae, designs, data tabulations and illustrations covering bearing applications for auxiliary equipment, cranes, drives and roll-neck bearing design maintenance and lubrication.

FLOORS So that any handy-man can make permanent repairs with the least possible effort, each operation is clearly planned and illustrated in "Tough Floors With Ruggedwear," a four-page folder available upon request to Flexrock Co., 23 and Manning Sts., Philadelphia, Pa.

GEARS Bulletin No. 861-42 contains information on the design and operating features of 861-4B light duty gear finishing machine of the Michigan Tool Co., Detroit, Mich.

GRAPHITE A 4-page bulletin, No. 421-D, on the use of "dag" colloidal graphite as a lubricant for running-in internal combustion engines, compressors and other mechanical equipment has been published by the Acheson Colloids Corp., Port Huron, Mich.

GRINDING A series of motion pictures entitled "Lessons in Grinding" are available from the Norton Co., Worcester, Mass. A folder describing the films contains illustrations, booking specifications and prices for permanent use.

HEAT TREATING Harold E. Trent Co., Leverington Ave. and Wilde St., Manayunk, Philadelphia, Pa., has prepared leaflet 42TA entitled "Modern Electric Furnaces for Heat Treating."

LATHES An 8-page catalog, No. 13, issued by the South Bend Lathe Works, Dept. A8, South Bend, Ind., completely illustrates and describes 13 in. toolroom lathes and engine lathes. A portion of the catalog is devoted to the construction features of the quick change gear box, carriage, spindle bearings and motor drive.

MAINTENANCE The proper care of high-cycle tools is outlined in an 11-page booklet entitled "Keep 'Em Working!" issued by The Rotor Tool Co., 17325 Euclid Ave., Cleveland, Ohio.

MARKING TOOLS More than 65 modern marking tools and machines are illustrated and described in the eight-page color brochure offered to those engaged in war work by the Acromark Corp., 7-13 Morrell St., Elizabeth. N. J.

MILLING A folder containing illustrations and descriptions of the operation and accessories of the Armor universal turret milling machine is offered by Aircraft Machinery Corp., Burbank, Calif.

MOTORS The construction and uses of Senacon air motors are illustrated and described in the four-page bulletin published by Smith-Johnson Corp., 623 East Twelfth St., Los Angeles, Calif.

MOTORS A set of seven bulletins on the installation, care and adjustment of motors have been prepared by Century Electric Co., 1806 Pine St., St. Louis, Mo.

PRODUCT CONTROL The Tablet & Ticket Co., 1021 W. Adams St., Chicago, Ill., offers a brochure, "T & T Visual Control Equipment" which details their method of visual work control.

PRESSES H-P-M hydraulic presses are described in a booklet issued by The Hydraulic Press Mfg. Co., Mount

W-S Standard Reamers with carbide tips. Tapered shank (illustrated) and straight shank types. Sizes: ¼ to 1½.

STANDARD REAMERS
available from stock

WE LIST as STANDARD many cutting tools formerly in the so-called "special" class. Better yet, the majority of these standard cutters is in stock most of the time. Our line is broad enough to often permit consolidation of tool orders thereby saving valuable time.

Cemented carbide tools are our *specialty.* We make them *exclusively.* Each tool is tipped with the *correct* grade of CARBOLOY best suited to do a cutting job on the metals for which the tool was ordered. (Other brands of carbide can be specified.)

You can expect and get uniform, high quality results with Wendt-Sonis tools. Catalog 942 mailed FREE upon request. Ask for it! WENDT-SONIS COMPANY, HANNIBAL, MISSOURI.

Wire or phone your requirements and priority rating.

W-S Carbide Tipped Core Drills available in straight and tapered shanks. Sizes: ¼ to 1½.

W-S Carbide Tipped Centers available in Morse, Browne & Sharpe and Jarno Tapers.

WENDT SONIS
CARBOLOY CUTTING TOOLS

CENTERS ★ FLUTE DRILLS ★ CORE DRILLS ★ COUNTERBORES ★ SPOT FACERS
END MILLS ★ REAMERS ★ HOLLOW MILLS ★ LATHE BITS ★ SPECIAL TOOLS

Capewell
CUTS TIME 54%
Sawing Stock for
REAMERS

TECHNITE

Hack saw blade costs are watched carefully by manufacturers of reamers. In one Eastern shop the saw required 37 minutes to cut a 5¼" bar of high-speed tool steel. Then our Capewell salesman suggested a test, and Capewell's Technite blades cut the time to 17 minutes. The Capewell blades *did* demonstrate they cut faster, last longer. At the same time, moreover, running a test enabled even this cost-minded shop to improve speeds and feeds. You, too, may find in your hack saw operations an opportunity for time-savings. It pays to run a test. And when you do, be sure also to test Capewell precision-cutting hack saw blades for faster cutting, longer life.

The Capewell Mfg. Co.
Hartford, Conn. U. S. A.

CAPEWELL

THE TREND IS TO TECHNITE
THE MOLYBDENUM HIGH SPEED HACK SAW BLADE

Gilead, Ohio. Various types of presses are illustrated and their specifications given.

PUMPS A 23-page bulletin, No. 940, issued by American Manganese Steel Division of the American Brake Shoe & Foundry Co., Chicago Heights, Ill., contains comprehensive data on the complete line of horizontal and vertical shaft centrifugal pumps.

PYROMETERS Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa., has reissued in up-to-date form Catalog N-33A, "Micromax Thermo couple Pyrometers." In 56 well-illustrated pages, this book gives information about available indicators, recorders and controllers and the thermo couples and accessories which are used with them.

RUBBER The B. F. Goodrich Co., Akron, Ohio, has just published a 30-page "Rubber Guide Book for American Industries," listing the application and properties of many types of products for industrial and aeronautical purposes using natural, synthetic or reclaimed rubber.

RUBBER CONSERVATION "How to get Longer Life From Mechanical Rubber Goods", is the title of a 24-page pocket manual offered by the New York Belting and Packing Co., 1 Market Street, Passaic, N. J.

SAFETY "Power Press Protection," a booklet prepared by Junkin Safety Appliance Co., Tenth and Hill Sts., Louisville, Ky., contains information of assistance in preventing press accidents.

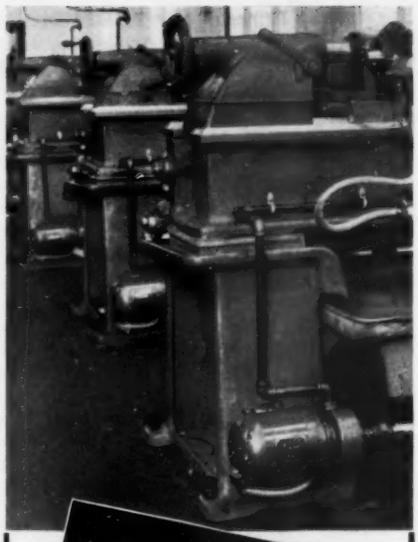
SCREWS The Parker-Kalon Corp., 200 Varick St., New York, N. Y., has prepared booklet No. 475 containing 20 pages covering all types of self-tapping screws and with illustrations showing typical applications.

STARTERS A bulletin offered by Allen-Bradley Co., 1311 S. First St., Milwaukee, Wis., describes their complete line of semi-automatic resistance starters for manually starting polyphase squirrel cage motors.

WASHERS Various types of metal parts washers, chemicals and processing equipment are described and illustrated in the 24-page book published by the Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich.

WELDING Trindl Products Ltd., 2227 Calumet Ave., Chicago, Ill., offers literature illustrating and describing Super industrial welding helmets and arc welders.

WELDING New practices of welding on positioners are described in an illustrated bulletin, No. WP 22, just issued for distribution by the Cullen-Friestedt Co., Chicago, Ill.



PIONEER
PUMPS

Answering the call of production in America's war plants are over 25 standard models of Pioneer Pumps—each one on the job to deliver the required flow of coolant to the work the instant it is demanded by the press of the button.

The range of models embraces applications to suit every condition that may be met—from large capacity pumps to small compact units for limited spaces.

Because the Pioneer Pump is able to handle fluid containing solids, chips, and dirt; and because its pressures are greater, this pump is selected in the leading plants doing war work. The absence of a gland and the perfect sealing of the liquid from the bearings reduce both maintenance and power consumption—both important factors today.

Many machine tool builders incorporate Pioneer Coolant and Lubricant Pumps as standard equipment on their product.

PIONEER PUMP
AND MANUFACTURING CO.
19651 JOHN R. STREET
DETROIT, MICH.

NEW BOOKS

THE ORGANIZATION AND TRAINING OF INDUSTRIAL FIRE BRIGADES—*By Captain John C. Klinck, Memphis Fire Department.* 119 *pages. Published by S. C. Toof & Company, Memphis, Tenn.* $1.

Having as its announced purpose the encouragement of the formation of industrial fire fighting brigades, this book has been prepared expressly for use by plant executives and fire department officers confronted with the problem of organizing and training such units.

The books suggests means to follow in organizing an industrial fire brigade program, from the steps necessary to arouse and enlist executives of local industrial organizations, through committee set-ups and activities, instructor's training schedule and teaching pointers, to lists of equipment needed. There are chapters dealing with knots used in fire service, use of fire extinguishers, small tools and equipment, handling of ladders and of hose. Later chapters deal with fire pumps, standpipes, sprinkler systems, fire alarm systems, plant inspections and organization of the fire brigade. Final chapters discuss means of checking sabotage, of combatting bombs and gas and of carrying on rescue work and salvage operations.

Full recognition is taken of the existing national emergency and of the fact that the protection of industrial establishments has become a matter of national importance, in a time when fire danger is magnified by the possibility of sabotage and by the presence of thousands of novice workers.

•

PLANT ENGINEER'S MANUAL—*By E. Molloy.* 231 *pages. Published by the Chemical Publishing Company, Inc.,* 234 *King St., Brooklyn, N. Y.* $3.

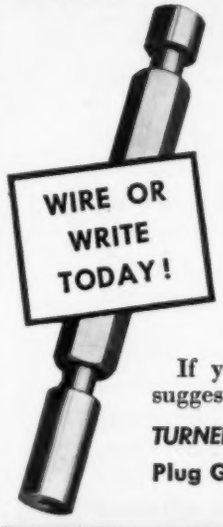
The plant engineer is one who must have more than a nodding acquaintance with the various types of electric motors used for driving all kinds of factory machinery. He is expected to have a knowledge of prime movers, and must be able to advise upon the most suitable methods of transmitting power from the prime movers to the various machines which are used in the plant. The information given in this book provides the plant engineer with a reference on such aspects of his work.

Sections of the book are devoted to sources and transmission of power. Included in the former is information on the selection, installation and maintenance of electric motors, steam engines, and internal combustion engines. In the section on transmission of power, the author covers the installation and maintenance of belts, ropes and roller-chain drives.

A third section is devoted to the operation and maintenance of pumps, compressed-air equipment, electric furnaces, electro-plating equipment, and

. . enables us to . .

deliver STANDARD *Plug* GAUGES within a few days!



● The Turner Gauge Grinding Company's new home was designed expressly for the manufacturing of gauges, and is considered by production men to be one of the best plants of its kind in the country. This new plant has enabled us to increase our production schedules so that it is now possible for us to carry in stock at all times standard plug gauge blanks turned up and hardened, ready for finishing and final inspection.

If you really need standard plug gauges in a hurry we suggest that you wire for prices immediately.

TURNER MANUFACTURES THE FOLLOWING KINDS OF GAUGES:

Plug Gauges • Ring Gauges • Snap Gauges • Special Gauges
Flush Pin Gauges

TURNER GAUGE GRINDING COMPANY
2628 HILTON ROAD . . . . FERNDALE, MICH.

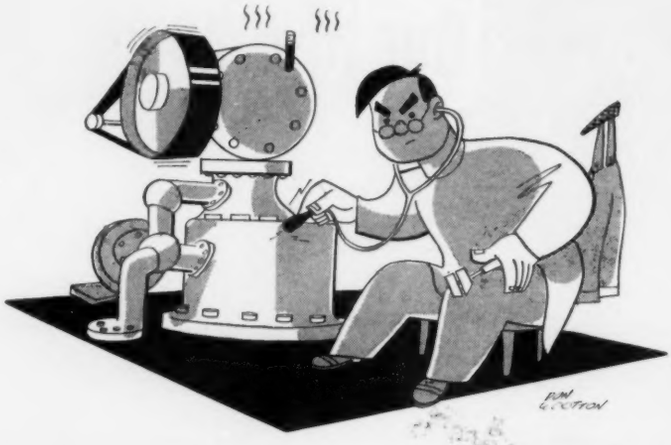
MAIL THIS COUPON NOW!

TURNER GAUGE GRINDING CO.
Ferndale, Mich.
Gentlemen:
Please rush price lists today.

Name .....
Street .....
City ..... State .....

☐ If enclosing order please check here.

The Stamp of Precision



AN OUNCE OF PREVENTION

All over the world many of our boys are "under fire" today. Who knows but that they may be in desperate need of weapons that aren't there.

WHY? Because some manufacturers couldn't deliver in time?

WHY? Because subcontractors were behind in their deliveries?

WHY? Because subcontractor's machines broke down?

We can't have breakdowns, today. There isn't time. Minutes are too vital.

Yet, with the wheels of war production turning night and day, breakdowns are more likely to occur.

The answer is *preventative maintenance* . . . which means keeping machines and other facilities in proper condition so that breakdowns will not occur.

This involves the application of the same sound principles of Management Engineering that are applied to all production processes. There must be constant planning and scheduling, checking and rechecking. Today, the risks are so great . . . we *must* be sure.

And let us never forget, "*Labor is just as efficient as Management plans for it and provides the tools with which to work.*"

Geo. P. Trundle Jr.

THE TRUNDLE ENGINEERING COMPANY

Consulting Management Engineering

GENERAL OFFICES · CLEVELAND · BULKLEY BLDG.
CHICAGO · City National Bank Bldg. · 208 S. La Salle Street
NEW YORK · Graybar Building · 420 Lexington Avenue

welding units. The final section of the book includes data on factory lighting, heating and ventilating, and the selection and installation of emergency and stand-by equipment.

•

ELEMENTARY METALLURGY—*By W. T. Frier, foundry control chemist, General Electric Company, and instructor in metallurgy, General Electric Technical High School, Erie Works. 199 pages. Published by the McGraw-Hill Book Company, 330 W. 42 St., New York, N. Y. $1.75.*

The author has presented the subject in a simple manner especially to give the student taking a technical course a knowledge of the characteristics of metals. The microstructure of metal is emphasized throughout with regard to such processes as forging, heat-treating, rolling and casting.

The internal structure of ferrous and non-ferrous metals and how strength, hardness, ductility and properties can be controlled are summarized in a chapter which is well illustrated with constitution diagrams, based on experimental work according to natural laws involving cooling curves, electrical conductivity, etc.

A chapter on testing covers Brinell, Rockwell and Scleroscope hardness tests together with a chart giving a comparison of values by all three instruments.

SEEN and HEARD

By JOHN GODFREY

Drilling Machine Maintenance

It does not seem as though there was much chance of anything going wrong with a drilling machine in these days of ball-bearing spindles. But one shop at least has found that on gang drills it isn't as uncommon as it should be, to find spindles that have been sprung out of line.

This is particularly true where the work is not large and is held in fairly small jigs that are slid along the table from one spindle to the next. Every once in a while some operator feeds a bit too fast, the drill catches in the work, and the fixture and all spin around on the table. In most cases this springs the spindle and makes it unfit for really nice work. So one shop keeps a supply of spare spindles and replaces the sprung spindle promptly in order to get accurate and satisfactory work.

New Cutting Angles in War Work

One of the interesting developments of war work has been a change in our ideas of cutting tool angles for differ-

ARE YOU GETTING *Maximum Service* FROM YOUR VISUAL GAGES?

1 Equipped with plain and serrated anvil for the checking of width, thickness, height, or outside diameter.

2 Equipped with flat anvil and thread wire attachment for checking pitch diameter of screw threads.

3 Equipped with standard backstop for accurate and rapid positioning of work being gaged.

4 Equipped with wide anvil and Sheffield sine bar fixture for the checking of tapers.

5 Equipped with Sheffield Internalgage for the checking of inside diameter, taper, and out-of-round.

6 Equipped with wide anvil and V-block for checking outside diameter of cylinders and bushings.

7 Equipped with fixture to check ball diameter of an inner ball race.

8 Internalgage with fixture to check a depth.

The Sheffield Visual Gage is used for many purposes. If you are not familiar with all of them, the outline here may suggest a means of increasing the effectiveness of your gages and the variety of work they do.

Sheffield Visual Gages are used:

In the Inspection Department

For the final inspection of close tolerance manufactured parts.

For the classification of such parts as the basis for selective assembly.

In the Tool Room

To check fixed size gages for wear.

To check precision gage blocks for wear.

To check the dimensional accuracy of tools.

In the Production Shop

To provide machine operators with an accurate check on work in process.

In the Receiving Department

To check dimensional accuracy of purchased parts and sub-assemblies on arrival.

In the Laboratory

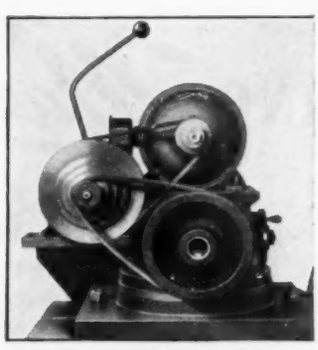
To provide maximum accuracy for measurements of all kinds.

THE SHEFFIELD CORPORATION

DAYTON, OHIO, U. S. A.

Looking down, from grinder head end.

Sav-way
MULTI–PURPOSE
INTERNAL
GRINDER



Looking from headstock end, guard removed; note step pulleys providing various work head speeds. Headstock may be slid crosswise any desired distance up to six inches.

Grinds ¼ to 18″ diameter holes, up to 9″ deep, straight or tapered. Sav-way grinder offers greater flexibility and will handle a wider range of work than has heretofore been possible on any one machine. Sturdily constructed throughout and suitable for both tool room and production grinding. "Bulletin MI" giving complete specifications sent on request.

Front, angle view, work in chuck. Headstock graduated thru 180 degree.

Representatives throughout the U. S. A.

Sav-way INDUSTRIES
★ Machine Tool Division ★
4873 EAST EIGHT MILE · DETROIT, MICHIGAN

ent materials. On armor plate and similar hard metals we find that a negative rake produces the best work when cemented carbide tools are used. This is contrary to all our previous ideas of cutting and cutting angles but it produces results, which is what we are after.

In drilling aluminum in its usual forms best results seem to be had with a single fluted drill having a 45 deg. helix and a point with an included angle of 85 deg. This same type of tool is found to work well in routing the edges of aluminum sheets with the work guided by a hardened roller against a steel plate or templet. In this case the point is blunted to almost the full diameter of the cutter. All these new ideas as to cutting tools will be equally useful in peacetime pursuits.

Inexperienced Inspectors Retard Arms Production

BY ARTHUR SILVESTER

The huge expansion of our armament program has resulted in the training of hundreds of new inspectors. Many of them are college graduates with little or no knowledge of machinery, yet they are given the responsibility of passing on the quality of vital mechanical parts. Few have had the opportunity to acquire mechanical training; not being familiar with the work, they are not competent to pass judgment on the workmanship of others.

The long peace-time program, the late depression and the natural death rate have left comparatively few thoroughly competent ordnance inspectors in the industry.

Young men need to be trained by older, experienced inspectors, either in government shops, or in the plants of contractors. In the latter case, a thoroughly competent inspector, with mechanical and teaching ability and authority to make final decisions, should be in charge of the plant corps of inspectors.

Because of the lack of such a set-up, vital gun parts are held up in our plant, while two or three weeks are spent in communication with the proper authorities seeking a final decision on some disagreement with our young chief inspector.

Some small defect, having no relationship to their efficiency in action, has caused many a gun, or gun part, to be scrapped or held up by inspectors. This has occurred due to the inspector's lack of knowledge of the effect, if any, the minor defect would have. Not being sure, he plays safe and rejects the piece.

We grind the outside diameter of the recoil cylinder, a length of approximately 35 in., first with a rough grinding operation and then with a special finishing wheel. This leaves a beauti-

ful finish and is within one ten-thousandth of an inch for roundness and for required diameter. A young chief inspector would not accept such parts and insisted on them being hand lapped lengthwise with a block of wood and abrasive paper. The additional operation takes approximately 2½ hours for each gun, destroys its roundness and makes our grinding operation useless.

While this inspector was on vacation, one of his colleagues inspected and passed about 20 guns that we did not lap. They were sent to Watervliet and accepted. When the original inspector returned from his vacation, lapping was again required.

Several other concerns are making the same gun, but we alone are lapping after grinding the recoil cylinder diameter.

For about 15 months we were forced to grind the long taper on the barrel after finishing turning. This operation wasted a total of 2,600 man-hours on 1,500 guns. The barrel, when finished, is painted and fits merely the open air.

Better Service From Files

By John E. Hyler

The file is a relatively low-priced tool, and is not always treated with the consideration it deserves. Files are thrown promiscuously together in a drawer, knocking the edges from the teeth. It will be far better, at any filing bench, to provide a place for each type of file, and keep it there.

A great deal of service loss is also sustained by using the wrong files for the work in hand. At times this is done through ignorance; at other times simply because the wrong file happens to be handy and is considered almost as good. In these days, file manufacturers have gone a long way to produce files suited to various kinds of metal. There are special files made for aluminum, brass and copper. Files for fiber, for foundry castings, for lead, magnesium or stainless steel all are available.

The proper care of files really includes the handles used with them, and also the file tips, in those cases where rubber filing tips are used. The latter are highly convenient for those who file for long periods by hand. Keep files fitted with good handles, and keep a file card handy, so that files may be cleaned regularly. There are some firms which specialize in the re-sharpening of files. This is an activity that will probably increase now that metals are at a premium, for files that are resharpened are naturally given another life term. More may be heard about chromium plating of files to increase their life.

Be sure that there are enough files of different cuts to do the work to the highest advantage. There are two general classes of ordinary hand files,

EXTRA *Life*
FROM YOUR PRESENT
AIR VALVES

IN these days of priorities and strenuous production schedules . . . let us see if we can't help you to get *extra* service out of the valves you now have . . . regardless of make.

Bring your air control problems to Ross.

ROSS *Operating* VALVE CO.
6489 Epworth Boulevard
DETROIT, MICHIGAN

In Grinding

DON'T OVERLOOK THIS VERY IMPORTANT FACTOR!

Stuart's CODOL

Liquid Grinding Compound

100% grinding efficiency is best accomplished by careful consideration of the grinding fluid factor. The vital part which a properly applied, specialized grinding lubricant plays is too often overlooked. It can mean unnecessary sacrifice in quality of finish production speed, and cost of wheels.

These handicaps can frequently be eliminated by going over your grinding problems with a STUART OIL Engineer. His highly specialized experience in the application of modern grinding fluids will help you secure top efficiency.

ASK FOR this informative booklet. Free working sample upon request. Please send your name on Company Letterhead.

For All Cutting Fluid Problems

D. A. STUART OIL CO.
LIMITED

Chicago, U.S.A. Est. 1865

Warehouses in All Principal Metal Working Centers

known as single cut and double cut, and each of these classifications is subdivided into three different tooth sizes. The first or largest-tooth file is called bastard-cut, the next second-cut and the third smooth-cut. There are some file makers producing files having wavy rows of teeth, which are claimed to be especially efficient in making a level and smooth cut.

There are many special files other than those especially adapted for different metals. There are, for instance, special die making files. There are special files for die castings. There is such a great array of different hand files that some firms have claimed to produce several thousand different types and sizes. For finishing by hand, some have claimed that Swiss-pattern files are best of all.

Those who have done a great deal of lathe filing know that special lathe files are available. If the proper type of file is used for this work with a slow lathe speed so that the file teeth can all get a good healthy bite at the work, good results can be obtained. Too high a lathe speed has been the cause of much poor lathe filing. Lathe filing has peculiar aspects. One of these is that work being filed in the lathe, because of its roundness, provides its own clearance, and none is needed on the file teeth. For this reason, where it is desired to do an especially smooth finish job of lathe filing, a file may be used which has been rubbed down to some extent with an oilstone.

Magneto or coil files are seldom used around the machine shop, yet there are cases where they are handy. There are even special files for use on slate and on plastics. Rotary files, as used in connection with portable tools and flexible shaft units, are made by a considerable number of firms, and have been increasing in use to a great extent of recent years.

"Safe" files have certain sides or edges that are left smooth, on which no teeth have been cut, to allow one to work freely up against a member from which nothing may be removed. Safe files are made in different types by representative file makers. It is well to remember, however, in case of an emergency, that one can make a safe file from any file, simply by grinding the teeth from the sides or edges where they are not wanted.

Oilstone files are perhaps not files according to the definition given by Webster, but they are fine files from the standpoint of the results obtained on fine work. Tools and dies of the most intricate type are filed in many places with files of this kind.

I once encountered a type of file known as a surfacing file. It was made for various kinds of repair and manufacturing work, and could be used like a hand plane. However, it could also be fastened in a vise, or fastened down to a benchtop, so that rather delicate work could be drawn over the file when it was found more practical to move the work than the file.

FOR *accuracy* CADILLAC THREAD RING GAGES

As specialists, we manufacture thread plug and ring gages for checking National and special form threads from your smallest size requirements to fifteen inches in diameter. Special thread checking fixtures and thread alignment gages are built to customer's design. Orders and re-orders from the largest armament manufacturers testify to the accuracy of CADILLAC Gages. *Let us serve you! !*

CADILLAC GAGE COMPANY
20316 Hoover Rd. Detroit, Mich.

★ MANUFACTURERS of

THREAD PLUG AND RING GAGES

AND OTHER THREAD CHECKING EQUIPMENT

Cadillac OF DETROIT

IT'S DOUBLY IMPORTANT NOW—

EXTEND THE LIFE OF YOUR FEEDING FINGERS AND COLLETS

Follow these suggestions to help feeding fingers and collets give longer and better service at a time when unusual demands are causing long delays for replacements:

Use only **CLEAN BARS** of stock. Dirty bars should be wiped clean before using. This is a major step toward longer life for collets and fingers.

AVOID BREAKAGE and work spoilage by keeping collets and the seats on which the collets rest, free from chips and dirt.

DO NOT DRIVE BARS into feeding fingers. See that all bars have a little chamfer on the end to aid them in entering the feeding fingers readily.

MAKE SURE the collet and finger are the **correct** size for the stock — otherwise breakage may occur.

USE FEEDING FINGER ADAPTERS to utilize the same finger in machines of different sizes — reduce the number of different fingers required for each size of stock.

IMMEDIATELY after removing a feeding finger or collet, clean it and place it in the proper storage compartment where it can be found easily for its next job — or by another operator.

These small details are important to keep your production high and to avoid delays that may occur due to the difficulty in obtaining new collets and fingers. It's **another** way in which you can help to **keep machines producing** for the united war effort.

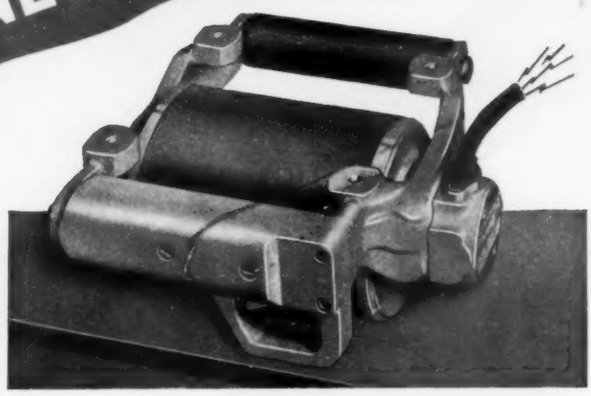
E
We are proud to be honored with the Navy "E", awarded for outstanding accomplishment in Defense production.
Brown & Sharpe Mfg. Co.
Providence, R. I., U. S. A.
BS

Reproductions of this advertisement for use on your bulletin board furnished on request.

BROWN & SHARPE

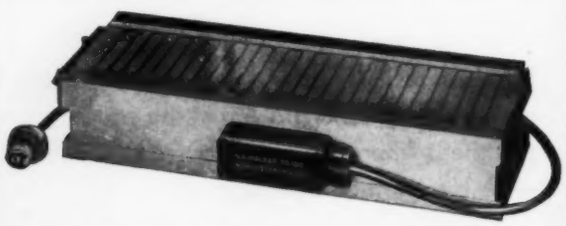
Walker Rotary Magnetic chuck with Concentric Gap—Style D—Face Plate — Walker Rotary Chucks are made in sizes from 4" to 72" diameter with Face Plate construction adapted to the work to be held.

STEP UP WAR PRODUCTION by saving set-up time with WALKER MAGNETIC CHUCKS*



Walker No. 617 Bar Pole Face Rectangular Magnetic Chuck, for holding small thin work. Sizes range from 6"x10" to 12"x60."

Walker Universal Swiveling Magnetic Chuck sizes 4"x10", 4"x20" and 4"x30"—can be arranged with Vernier Reading.



Walker No. 618 Rectangular Magnetic Chuck—available in sizes from 4"x8" to 30"x96".

WALKER DEMAGNETIZERS

These units are available from Walker in standard D.C. and A.C. types for 110 or 220 V service. They provide a fast and convenient means of removing residual magnetism from a wide variety of parts. Send for Circular K7 giving detailed information.

•

Because of their ability to hold work securely under heavy cuts, Walker Magnetic Chucks fit into the demand for high production of war materials. Then, too, these dependable units contribute to more and better work in less time.

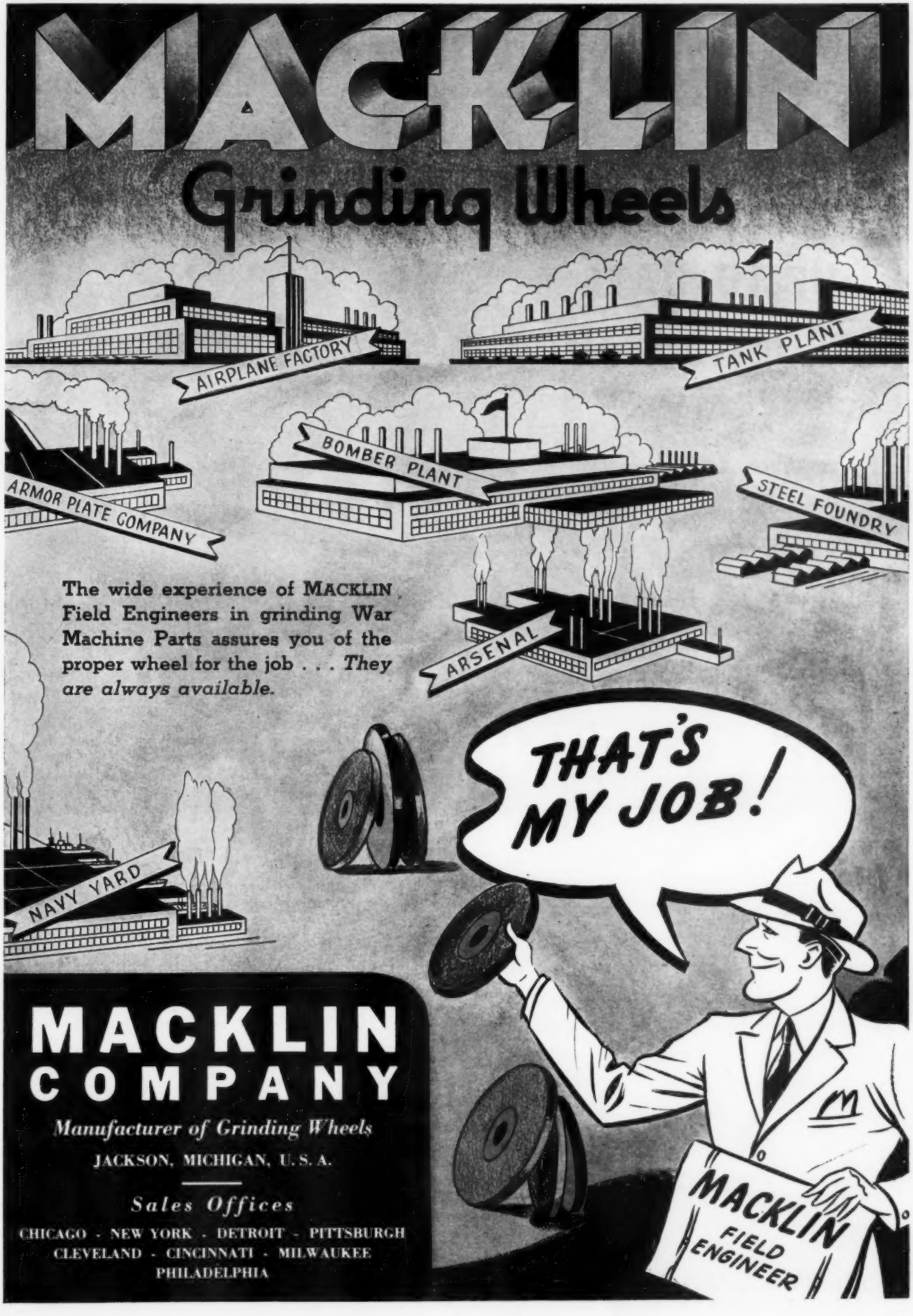
Of proved design and utmost dependability, Walker Magnetic Chucks in Rectangular and Rotary Types help speed up grinding, milling, planing and turning operations. Standard units are available for practically any chucking need. A complete range of sizes makes it possible to select exactly the right Walker for your problem. Magnetic chucks for special requirements can be furnished in reasonably short time.

Come to Walker for magnetic chucks and you'll save time and speed up war production.

Write for catalog No. W4 giving complete information

O. S. WALKER CO., Inc.
Worcester, Mass., U.S.A.

MACKLIN
Grinding Wheels



The wide experience of MACKLIN Field Engineers in grinding War Machine Parts assures you of the proper wheel for the job . . . *They are always available.*

MACKLIN COMPANY

Manufacturer of Grinding Wheels

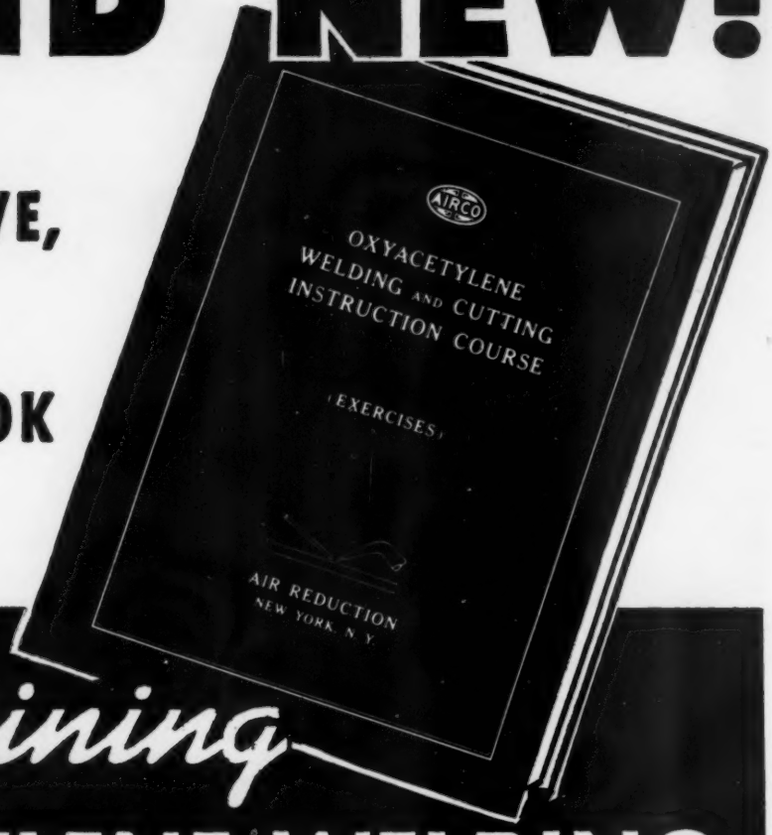
JACKSON, MICHIGAN, U. S. A.

Sales Offices

CHICAGO - NEW YORK - DETROIT - PITTSBURGH
CLEVELAND - CINCINNATI - MILWAUKEE
PHILADELPHIA

BRAND NEW!

A COMPREHENSIVE, UP-TO-DATE INSTRUCTION BOOK



For Training OXYACETYLENE WELDING and CUTTING OPERATORS

This book starts at rock bottom—instructs the beginner on set-up of apparatus. It describes welding fundamentals—methods, torch and rod positions and manipulation... procedure for welding, braze welding and low temperature brazing. Lessons cover steel, pipe, sheet metal, cast iron, brass, copper and aluminum.

Without question, this Airco Oxyacetlyene Welding and Cutting Instruction Book will prove an invaluable aid to quickly train oxyacetylene torch operators to meet today's needs. $1.00 per copy, quantity prices on request.

Air Reduction

General Offices: **60 EAST 42nd ST., NEW YORK, N. Y.**

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MAGNOLIA-AIRCO GAS PRODUCTS CO.
General Offices: **HOUSTON, TEXAS**
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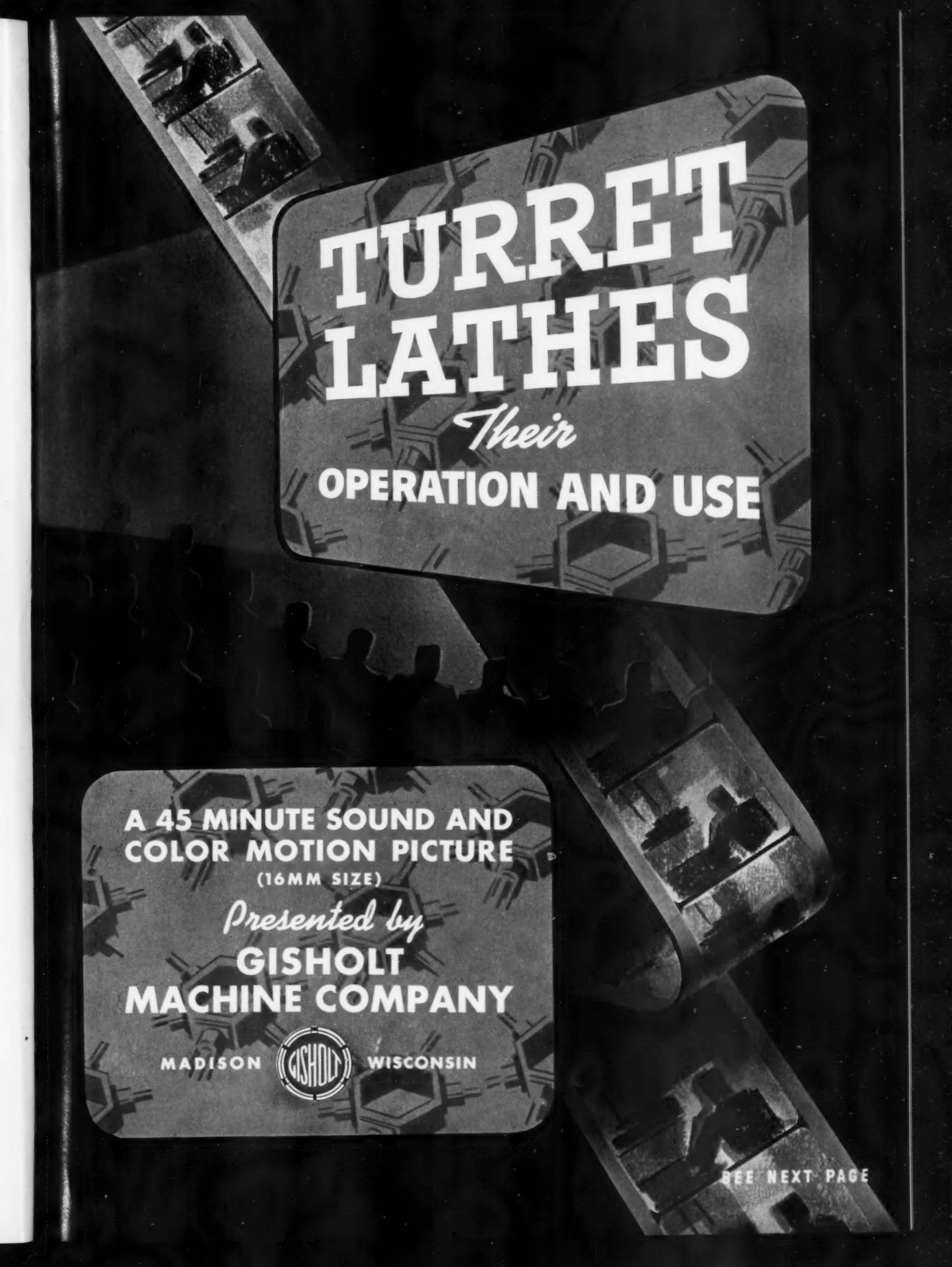
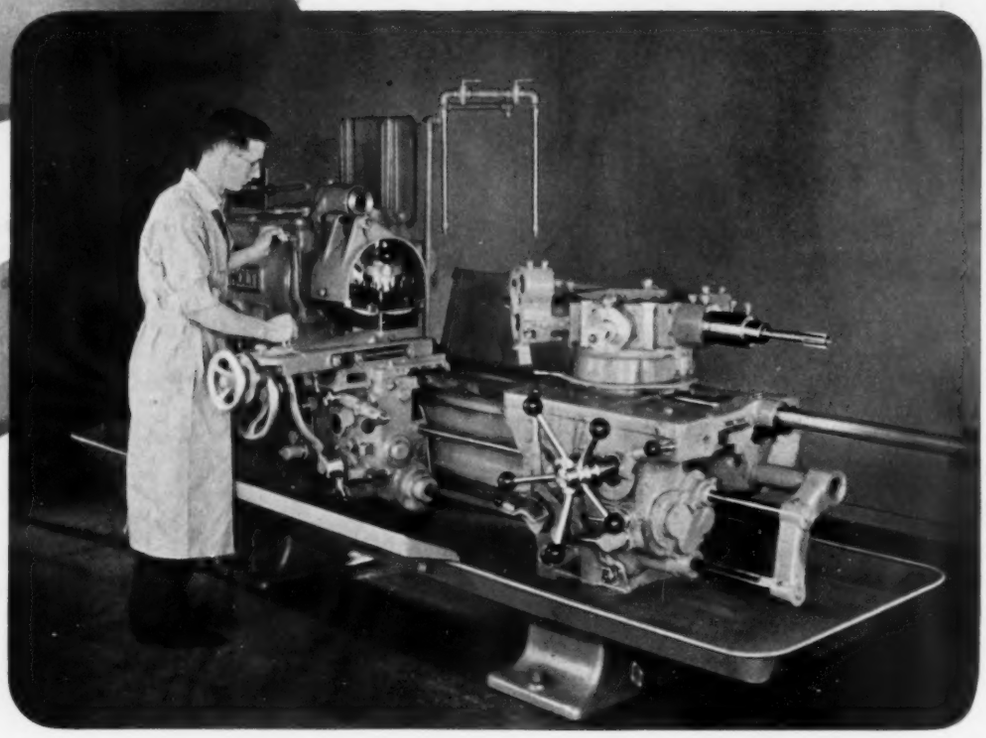
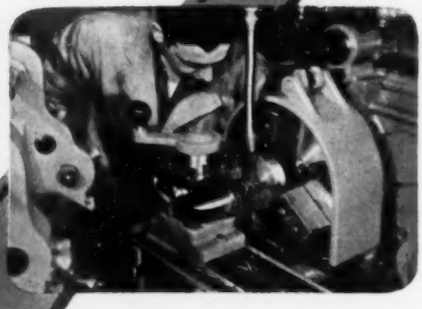
AIRCO WILSON

OXYGEN IS PRODUCTION — *Don't Waste it!*


TURRET LATHES
Their
OPERATION AND USE
A 45 MINUTE SOUND AND COLOR MOTION PICTURE
(16MM SIZE)
Presented by
GISHOLT MACHINE COMPANY
MADISON
GISHOLT
WISCONSIN
SEE NEXT PAGE



TO TRAIN TURRET LATHE OPERATORS *Faster*



Produced by the Gisholt Machine Company in collaboration with Burton Holmes Films, Inc., this new sound-color film, "TURRET LATHES—THEIR OPERATION AND USE" shows the place of the turret lathe among machine tools, illustrates typical tooling set-ups, and outlines fundamental operations.

AVAILABLE FOR USE BY TRADE SCHOOLS, ETC.

To assist the war program with faster training through a better understanding of these turret lathe functions, this interesting and instructive film is loaned without charge to Army and Navy training schools, trade schools, colleges, industrial plants, apprentice shops, etc. Such recognized organizations are invited to write us for further information.

GISHOLT MACHINE COMPANY
East Washington Avenue • Madison, Wisconsin

TURRET GISHOLT LATHES

LOOK AHEAD...KEEP AHEAD...WITH GISHOLT IMPROVEMENTS IN METAL TURNING

SECOND FRONT STRATEGY needs home front strength. For maintenance of top output with longer tool life between regrinds in *MACHINING* use . . .

. . . SINCLAIR CUTTING OILS AND COOLANTS. These oils promote high accuracy and clean finish in stepped-up cutting operations.

Write for "The Service Factor"—a free publication devoted to the solution of lubricating problems.

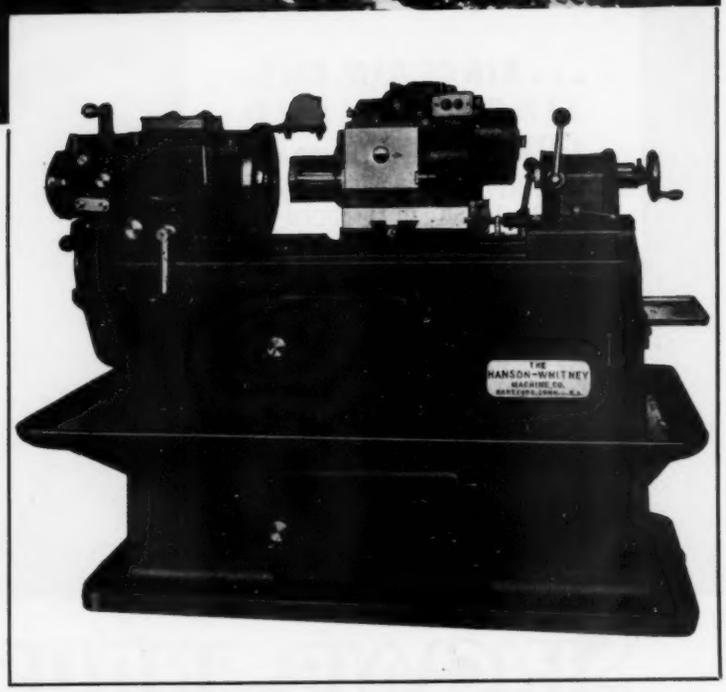
SINCLAIR INDUSTRIAL OILS

FOR FULL INFORMATION OR LUBRICATION COUNSEL WRITE NEAREST SINCLAIR OFFICE

SINCLAIR REFINING COMPANY (Inc.)

2540 West Cermak Road, Chicago • 10 West 51st Street, New York City • Rialto Bldg., Kansas City • 573 West Peachtree Street, Atlanta • Fair Building, Ft. Worth

H-W Universal Semi-Automatic Thread Milling Machines are playing an important part in producing the ships to ply our seaways . . . are producing for shipbuilders on both oceans the accurate, close-limit work required by our expanding navy and merchant marine. The H-W Milling Process permits the working of many previously hard-to-thread materials . . . and, by applying the multiple cutter principle, threads of all lengths within the capacity of the machine are completed in one revolution. External, internal and taper threads . . . right or left hand . . . can be cut with equally high speed, precision accuracy and convenience. If you have a threading problem call Hanson-Whitney.



Hanson-Whitney 8" x 16" Semi-Automatic Thread Milling Machine

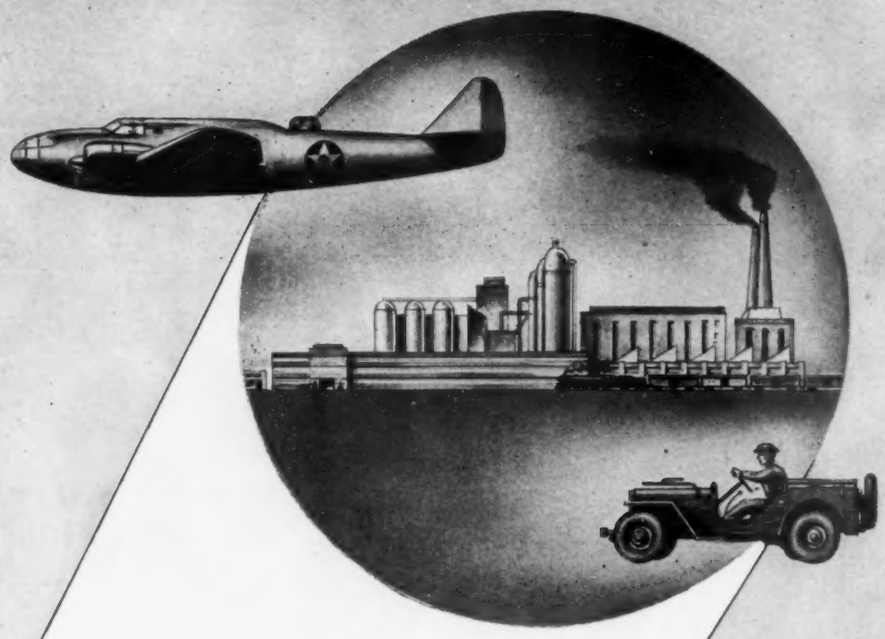
The HANSON WHITNEY MACHINE CO

HARTFORD CONN., U.S.A.

"Keep 'Em Cutting"

This is the Victory slogan of every worker in the Vanadium-Alloys Plants . . . our tool steels are doing their bit on the production firing lines of America . . . cutting, forming and stamping weapons of Victory for the United Nations.

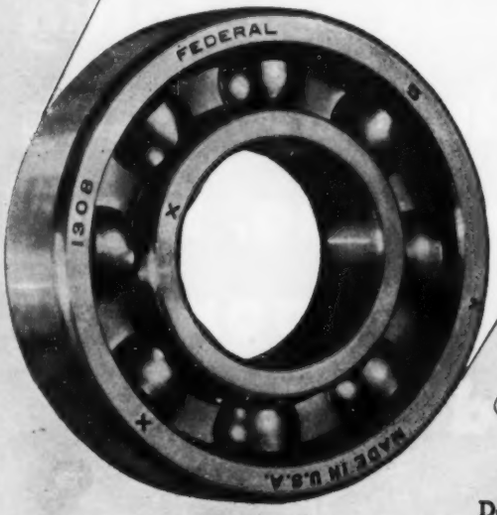
Vanadium-Alloys
STEEL CO., LATROBE, PA.



TRADE MARK

FEDERAL

BEARINGS



TRADE MARK

THE FEDERAL BEARINGS CO., INC.

Makers of Fine Ball Bearings

U. S. A.

REPRESENTATIVES LOCATED AT

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Reduced Voltage Starters

for squirrel cage electric motors when starting torque or starting current must be limited

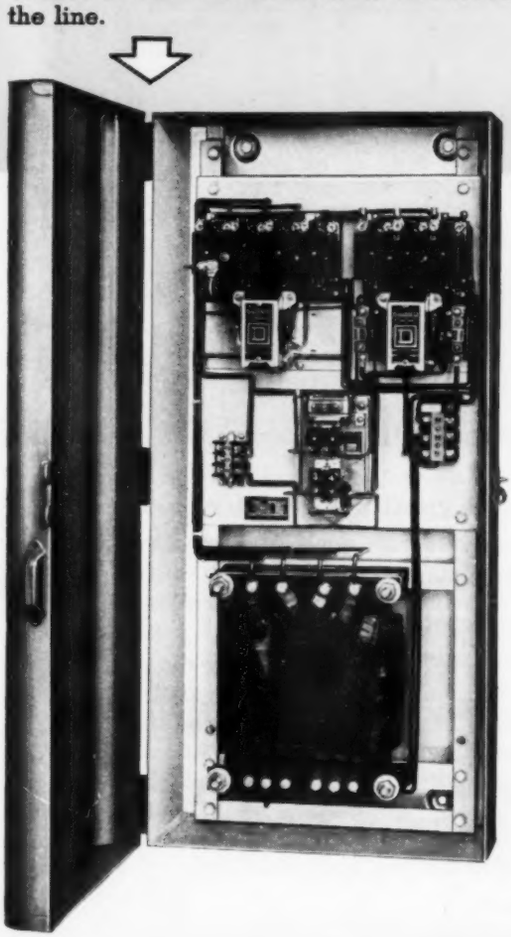
PRIMARY RESISTOR TYPE STARTERS for smooth acceleration with increasing torque as motor comes up to speed.

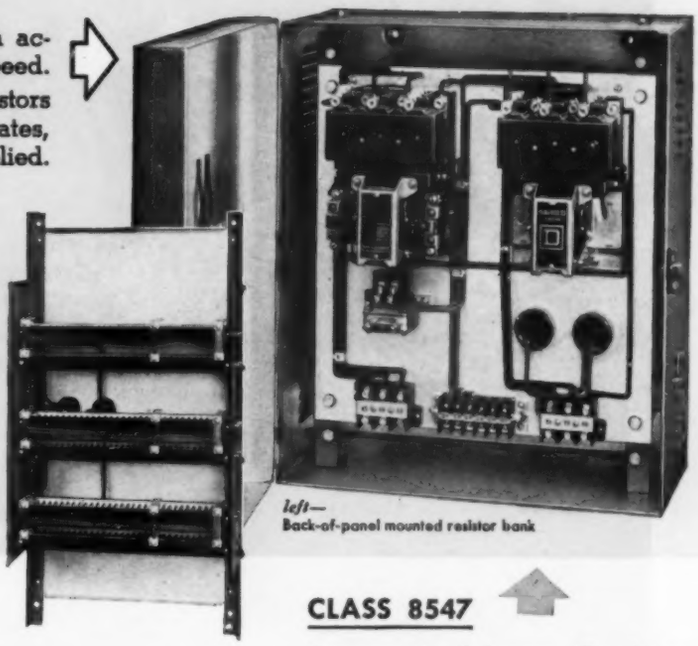
Voltage is reduced at motor terminals by connecting resistors in series during the starting period. As the motor accelerates, these resistors are shorted out and full line voltage is applied.

• • •

COMPENSATOR TYPE STARTERS for lowest starting current with a given starting torque.

Voltage is reduced during the starting period by means of an autotransformer. As the motor accelerates, it is disconnected from this transformer and reconnected across the line.





left—
Back-of-panel mounted resistor bank

CLASS 8606

Square D Compensators offer these features:

- Autotransformers having taps to provide 50%, 67% or 84% of line voltage to start. (Approximately 44%, 78%, or 124% starting torque and 150%, 270%, or 425% starting current.)
- Three phase types for motors up to 100 H.P., 220 volts or 200 H.P., 440 volts.
- General purpose, water-tight, dust-tight or Class II, Group G enclosures.

CLASS 8547

Square D Primary Resistor Starters offer these features:

- Balanced resistor sections for each phase, designed to give 70% line voltage to start.
- Single, two, or three phase types. Maximum ratings 100 H.P., 220 volts or 200 H.P., 440 volts.
- Reversing or non-reversing types with general purpose or dust-tight enclosures.
- Resistors for 5 H.P. and larger starters are Edgerest type. This construction requires only half the space and one-quarter the weight of conventional grid types.

Both forms of Reduced Voltage Starters offer these features:

- Definite time acceleration governed by adjustable pneumatic timing relays. Starting period is the same every time—no danger of improper starting by inexperienced operator.
- Overload protection by non-tamperable melting alloy type thermal relays.
- Two or three wire remote control—low voltage protection or release.

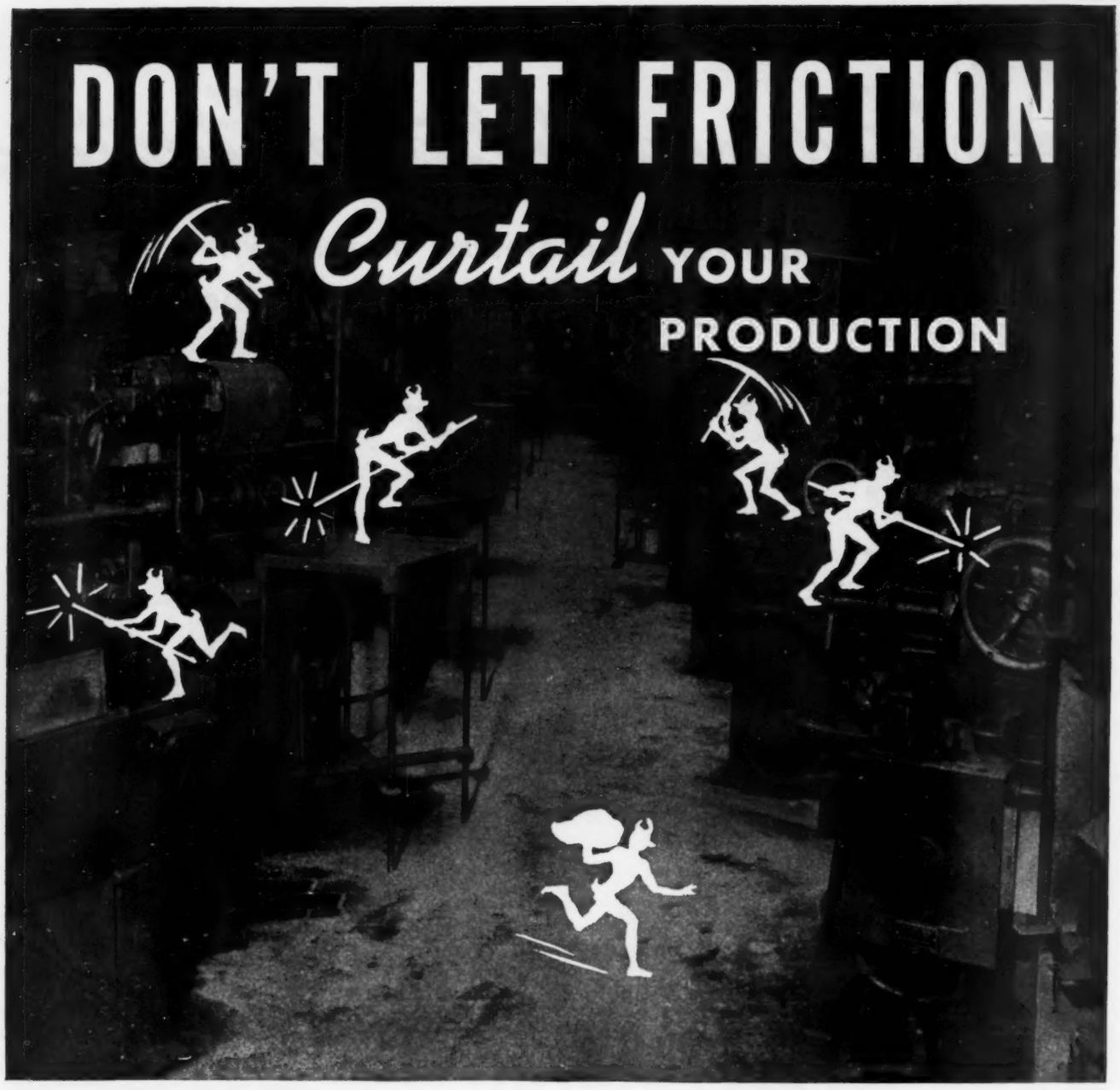
SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

KOLLSMAN INSTRUMENT DIVISION, ELMHURST, NEW YORK

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

CALL IN A SQUARE D MAN



In the high-speed drive for Victory, FRICTION finds its greatest opportunity. Machine operators have rest intervals, but the machines themselves have none. And so, normal inspections and adjustments may be overlooked—lubrication may be neglected—a bearing becomes dry or dirty, and over-heated—FRICTION'S agents get in their deadly work—and A DAMAGED, BURNED-OUT OR RUINED BEARING CRIPPLES A VITAL TOOL.

Let NORMA-HOFFMANN engineers help you guard your bearings against FRICTION'S "saboteurs"—dust, dirt, grit, moisture, poor lubricants, inadequate lubrication. Give each bearing periodic inspections—watch for unusual noise or heat—keep your bearings clean—use the lubricant best adapted to the duty involved. If possible, have replacement bearings at hand. * * * Our engineers are at your service, with 30-odd years of specialized experience in bearing application, operation and maintenance.

NORMA-HOFFMANN BEARINGS CORP'N., STAMFORD, CONN. . . . FOUNDED 1911

Mazlo extruded shapes are helping to speed the output of combat equipment. Metal is placed exactly where it's needed in these sections, giving highest metal economy. There are fewer steps between raw stock and finished parts.

Powerful hydraulic extrusion presses, putting tons of pressure behind heated Magnesium Alloy ingots, push the metal through the extrusion dies. Bar stock and standard structural sections, tubing, seamless hollow shapes and a great variety of complicated special shapes are produced.

Before the war, Mazlo extruded shapes were fast becoming an important time and labor saver for users of this lightest of lightweight metals. American Magnesium engineers helped develop special sections which enabled manufacturers to by-pass many finishing operations. Today, of course, every foot of extrusions we can make is going into fighting equipment.

After the war, there's going to be an abundance of Magnesium for all uses. Our engineers will gladly work with your designers of postwar products to take full advantage of the economies offered through the use of extruded shapes. Write Aluminum Company of America *(Sales Agent for Mazlo Magnesium Products)* 1709 Gulf Building, Pittsburgh, Pennsylvania.

AMERICAN MAGNESIUM CORPORATION

SUBSIDIARY OF ALUMINUM COMPANY OF AMERICA

MAZLO MAGNESIUM PRODUCTS

BLASTING

PRODUCTION JAMS is our specialty

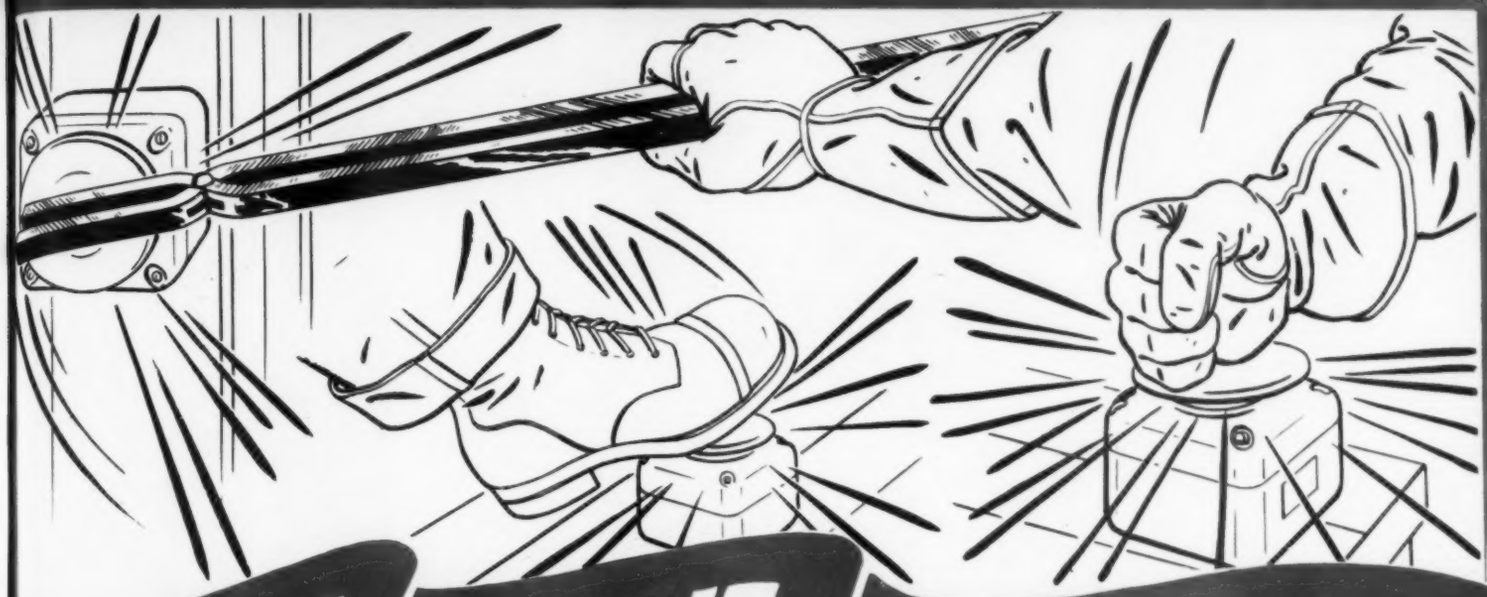
DAY BY DAY, production problems get tougher. Yet a way to solve them must be found . . . and quickly. That's where Shell men come in.

They think in terms of new ideas . . . ideas to make Shell Lata Cutting Oils produce better work, faster. What's more, they know how to combine these ideas with the practical knowledge gained through working with scores of plants on their cutting oil problems. As a result Shell has developed a control technique that "balances" the oil to the specific job at hand . . . fits the oil to the machine, the application and the tool.

Call in the Shell man now. Let him show you how this technique can cut machine down-time, improve surface finish, increase tool life in your plant.

SHELL LATA OILS *for Cutting*

SHELL



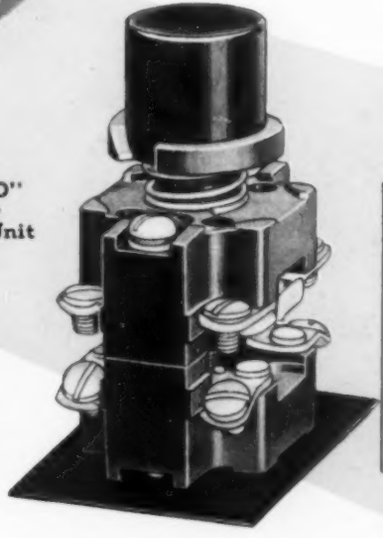
HIT IT · KICK IT · PUNCH IT

It still does the work

These units feature silver-to-silver, button type Double Break Contacts, large electrical clearances, Bakelite insulating parts, push button stop independent of contacts, and all parts removable and replaceable with a screwdriver.

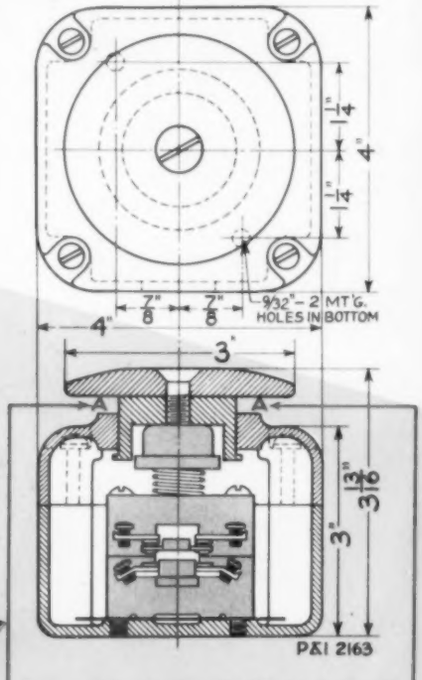
For installations where hard service is encountered, the ROUGHNECK will be entirely satisfactory.

The Real "Roughneck" of the "3C" Push Button Family



"3C" Type "D" Heavy Duty Push Button Unit

The ROUGHNECK is low and squatty—built close to the ground—and with plenty of "bearing area" so that rough and ready usage doesn't rock him on his base. If you miss that smoothly, flatly curved disc with blows, kicks, or punches, the impact slides smoothly off the shoulders. Observe in the cross-section the husky neck supporting the disc. That's strength to "grin and bear it" under gruelling punishment.



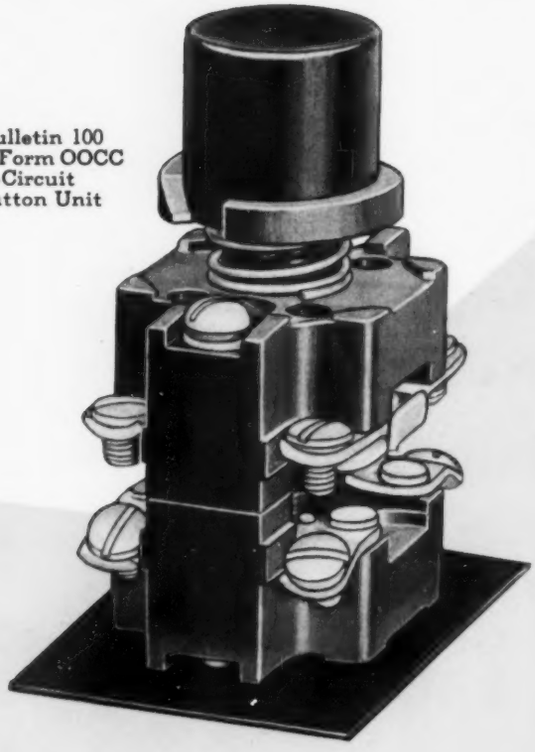
Impact shock absorbed here, instead of on insulation material, which is indicated in red shaded portion of drawing.

CONTINUE TO ROLL WITH CLARK CONTROL

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

It Never Gets "SLAP HAPPY"



"3C" Bulletin 100
Type "D" Form OOCC
Four-Circuit
Push Button Unit

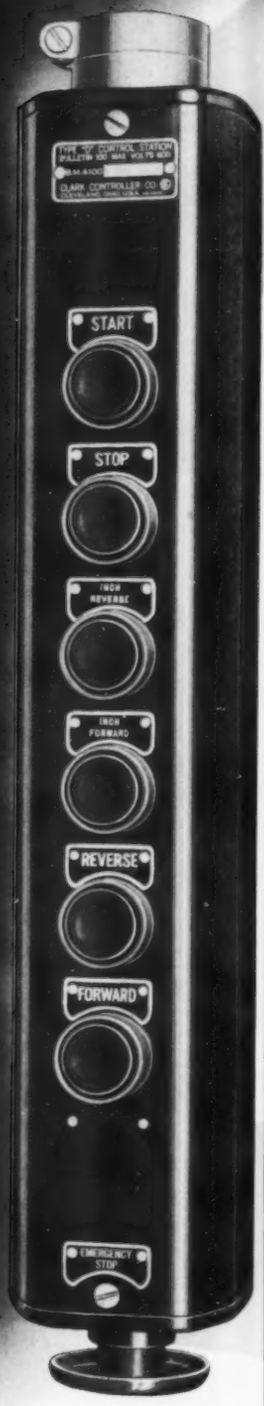
THIS sturdy Push Button unit is ruggedly built to stand frequent operation. Silver-to-Silver Button Type Double Break Contacts insure long life, while all insulating parts are Bakelite in heavy section to deliver service.

In operations such as on Power Presses, "3C" Pendant Push Buttons provide a double element of safety, as the station is suspended so that the operator's hands are kept out of the danger zone and the "EMERGENCY-STOP" button is easily located at the bottom of the case.

This Palm-Operated Button can be slapped with the open hand, requiring no searching to locate, thus providing prompt action.

To insure plenty of room for bringing in all wires through the top knockouts, the space normally occupied by one unit is left at the top of the enclosure.

Open View
"3C" Bulletin 100
Pendant
Push Button
Station



Closed View
"3C" Bulletin 100
Pendant
Push Button
Station

These Pendant Stations can be supplied in from 1 to 6 units on the face of the enclosure, and the Palm-Operated Mushroom Head on the bottom. The Clamp Collar at the top adds $1\frac{1}{4}$" and the Mushroom Head adds $1\frac{3}{16}$", or a total of $2\frac{3}{16}$", as shown on the dimensions below.

No. of Units	Encl. Length	Add for Collar & M.H.	Total
1	$8\frac{1}{8}$	$2\frac{5}{16}$	$10\frac{7}{16}$
2	10	$2\frac{5}{16}$	$12\frac{5}{16}$
3	$11\frac{7}{8}$	$2\frac{5}{16}$	$14\frac{3}{16}$
4	$13\frac{3}{4}$	$2\frac{5}{16}$	$16\frac{1}{16}$
5	$15\frac{5}{8}$	$2\frac{5}{16}$	$17\frac{15}{16}$
6	$17\frac{1}{2}$	$2\frac{5}{16}$	$19\frac{3}{16}$

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

"For the want of a nail . . ." the shoe, the horse, the rider, the battle — and, consequently, *the whole war* — were lost. So goes the old schoolbook legend whose moral points to the importance of little things in the achievement of big things.

It takes DETAILS — *millions* of details! — to arm a war-winning nation. None are so trivial that they can be completely ignored.

Every industry has its vital details. Where filing operations are concerned, there's almost no end to them. Managements, production heads and shop foremen can achieve much by educating workers in the PROPER USE, PROPER CARE and PROPER SELECTION of files. Each of these phases covers many points having a vital bearing on:

Saving time in product production,

Saving materials—including that used in the files themselves;

Increasing workers' efficiency; reducing work spoilage, corrections and rejects.

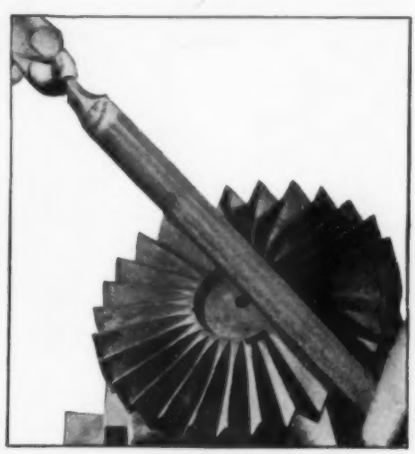
In addition to making files for every purpose, Nicholson is interested in every purchaser getting the most out of them. Toward this end, there are Nicholson service engineers assigned to the industrial field. Nicholson mill-supply houses are assisted in being similarly helpful. Nicholson printed material is offered as follows:

FREE WALL CHART on Regular Purpose and Swiss Pattern File shapes, cuts and sizes.

FREE BOOK (28 pages) for elementary information on the proper use, care and selection of files.

FREE TECHNICAL BULLETINS on Nicholson or Black Diamond Special Purpose Files for: Stainless Steel, Aluminum, Brass, Lead, Plastics, Foundry Castings, Die Castings, Die Making, Shear Tooth and Lathe filing. Name ones wanted.

NICHOLSON FILE CO., PROVIDENCE, R. I., U. S. A.
(Also Canadian Plant, Port Hope, Ont.)

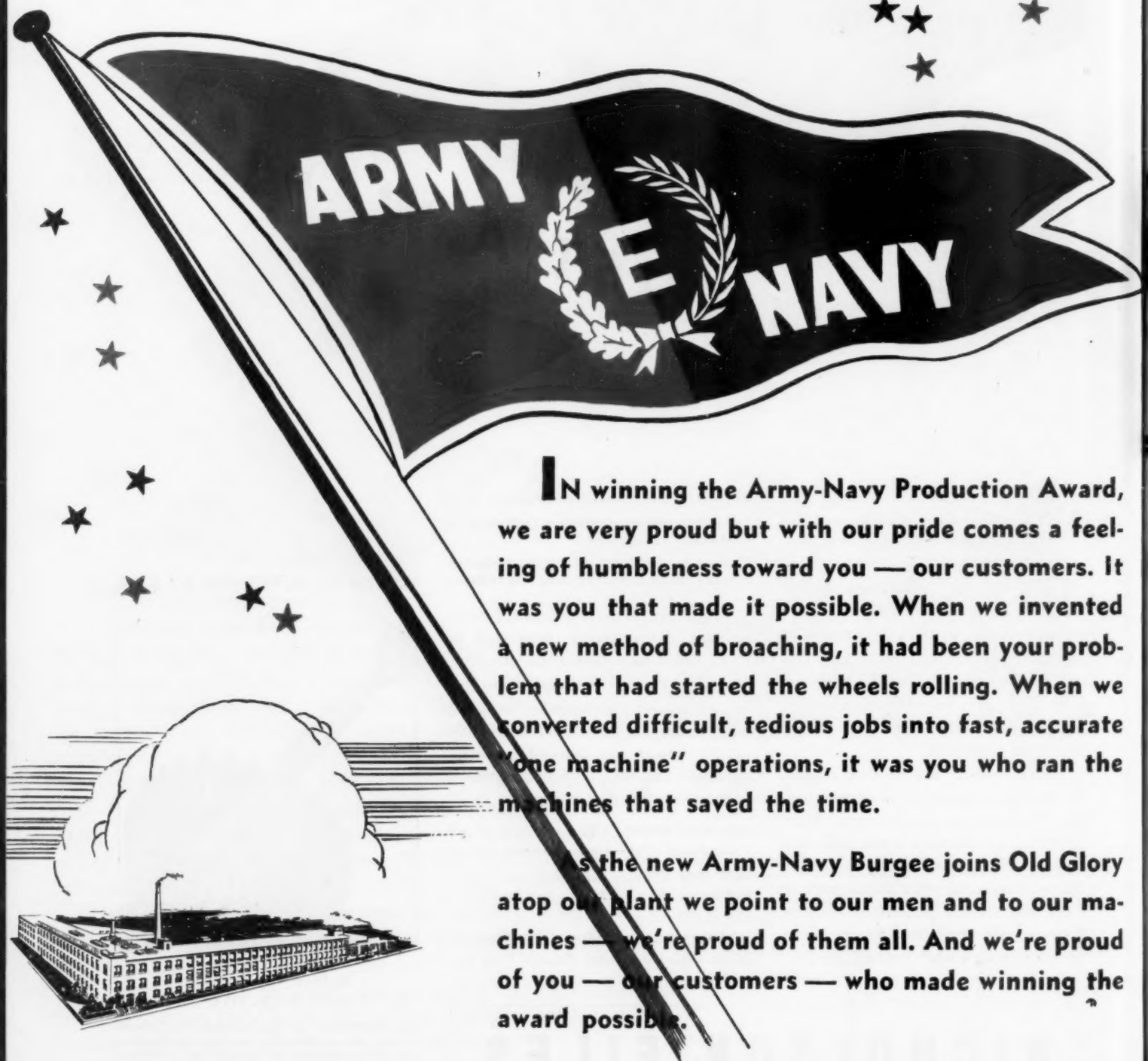


Better filing with
THE RIGHT FILE FOR THE JOB

DIE CASTINGS. On die castings of aluminum-alloy or similar metals you can do a fair finishing job with an ordinary file. But you can do it much faster and more accurately with a Nicholson or Black Diamond Special Die Cast File. Its extra-strong teeth on the sides resist shelling off and breaking out. Its design minimizes the tendency of these metals to clog the file. Obtainable through your mill-supply house.

NICHOLSON FILES
FOR EVERY PURPOSE
NICHOLSON U.S.A. MADE IN U.S.A.

WE SHARE OUR

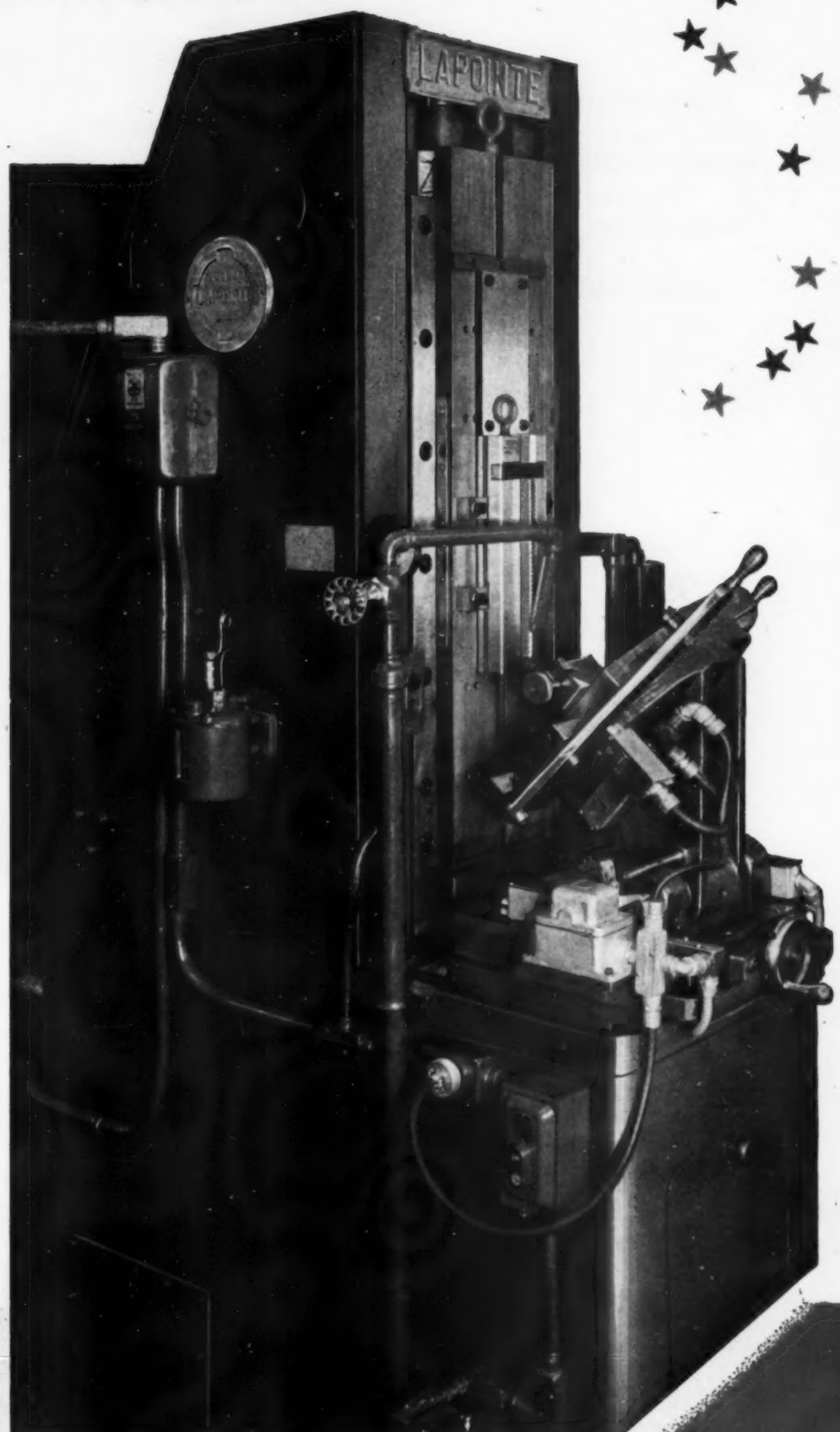


IN winning the Army-Navy Production Award, we are very proud but with our pride comes a feeling of humbleness toward you — our customers. It was you that made it possible. When we invented a new method of broaching, it had been your problem that had started the wheels rolling. When we converted difficult, tedious jobs into fast, accurate "one machine" operations, it was you who ran the machines that saved the time.

As the new Army-Navy Burgee joins Old Glory atop our plant we point to our men and to our machines — we're proud of them all. And we're proud of you — our customers — who made winning the award possible.

LAPOINTE MACHINE TOOL

HONORS WITH YOU



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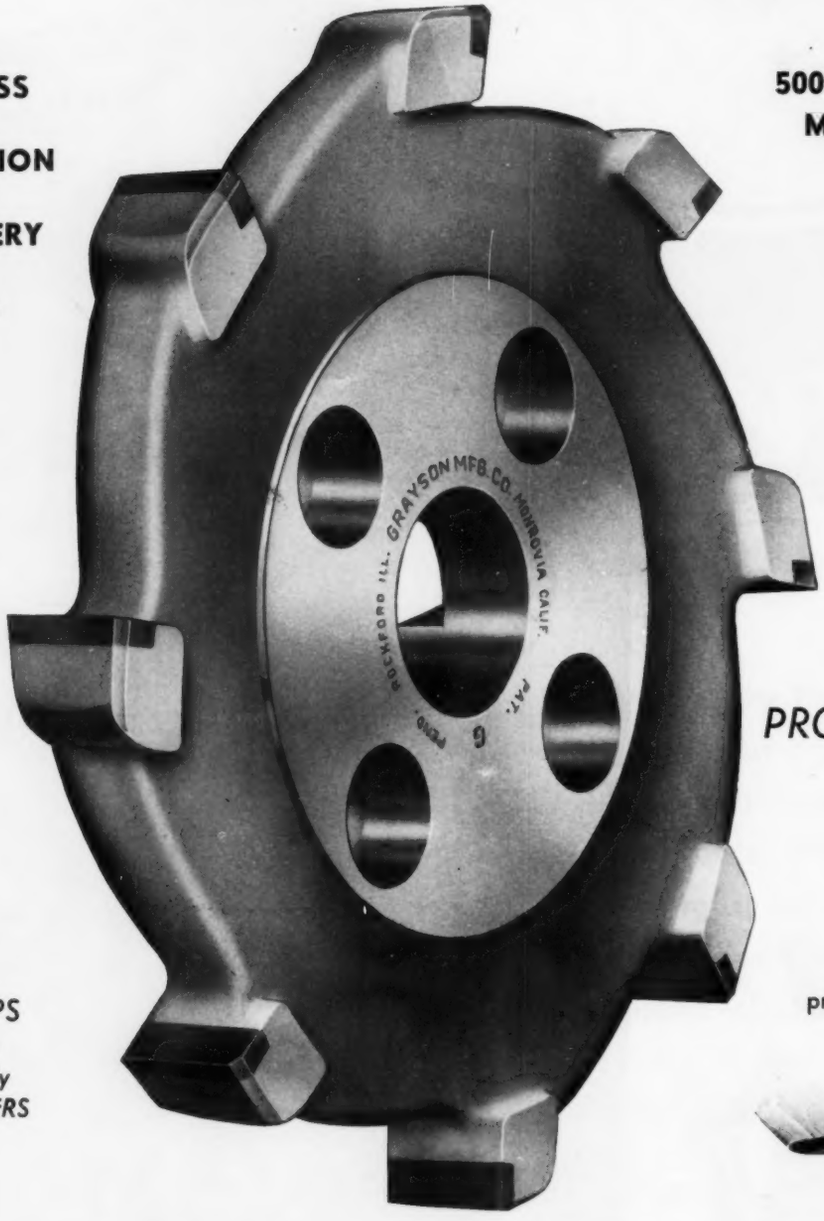
HUDSON, MASSACHUSETTS

RIGHT on the NOSE,

RIGIDLY clamped, with four **STOUT** screws,
is the **IDEAL MOUNT** for **CEMENTED CARBIDE**
FACE MILLING CUTTERS

A NEW PROCESS
and
MASS PRODUCTION
permit
PROMPT DELIVERY
at
LOW PRICES

500% TO 1000%
MORE PARTS
per
grinding
of
cutter



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DOUBLE PRODUCTION

ALL CARBIDE TIPS
Bonded to Grayson cutters, are nationally RECOGNIZED LEADERS

satisfactory
preference rating
essential

The Illustration on this page is the exact size of
our **6½" FACE MILL** for mounting on a **#40 SPINDLE** nose **PRICE $43.00**
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IMMEDIATE DELIVERY ON SPECIAL FACE MILLS FOR ALUMINUM, BRASS AND CAST IRON. IN ORDERING, SPECIFY "ABC"

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"MORE MILLING WITH LESS MACHINES"

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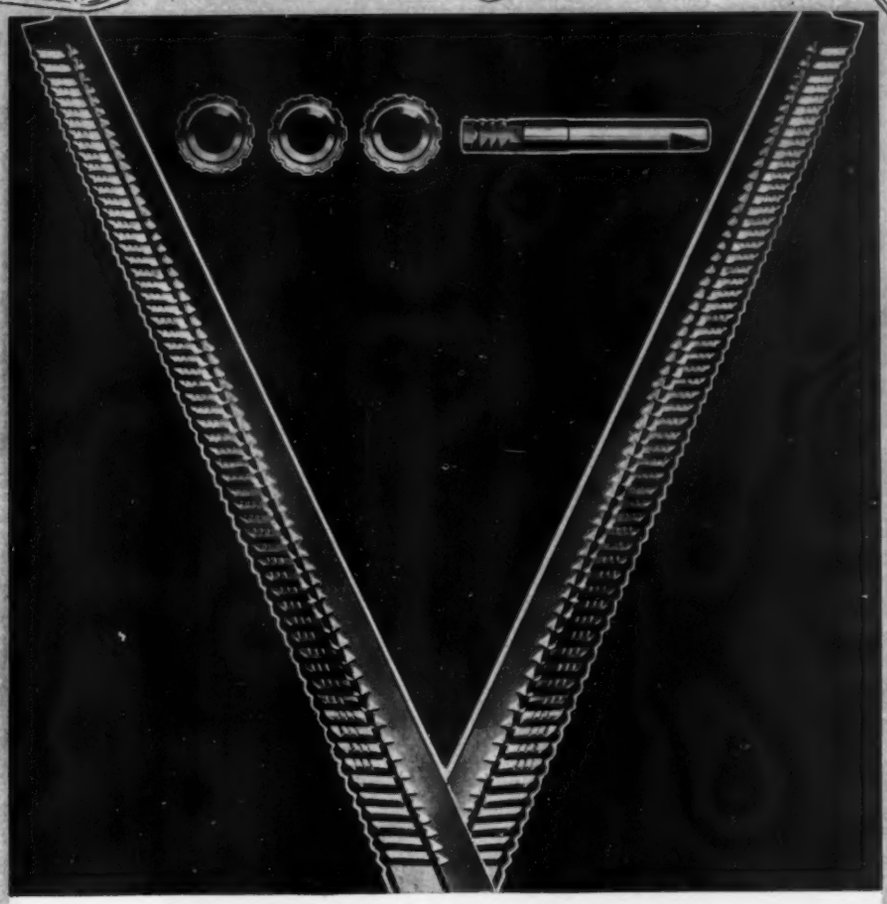

HELL BENT for VICTORY

Everyone in our organization, men and women alike, are concentrating on production—the conservation of the tools and materials with which they work and assistance to the utmost to anyone desiring our services, in the hope that by so doing complete Victory will be ours much sooner than we dared believe.

NATIONAL Tools CLEVELAND

THE NATIONAL TOOL COMPANY

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are AMERICAN Short-Center DRIVES, either flat-belt or V-belt, with AMERICAN Econ-O-Matic MOTOR BASES for automatic tension control—and thus automatic economy.

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This practical 36-page illustrated book gives all the answers why every belt-driven machine deserves an Econ-O-Matic Drive.

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He would . . . naturally. He hardly ever has to move. Notice how the operating controls are all placed conveniently on the front panel. This is typical of the man-saving design that distinguishes the No. 3 and No. 4 Motch & Merryweather Cold Sawing Machines from end to end.

★ ★ ★

Give him a fast, accurate, rigid Motch & Merryweather Cold Sawing Machine, and watch him go! He'll like it. For the best results give him, too, Motch & Merryweather Segmental Saw Blades and the Motch & Merryweather Saw Grinder.

The No. 3-AS (special) Motch & Merryweather Cold Sawing Machine shown above has a capacity of 9⅝" round and 6⅜" square stock, using a standard 28" blade. Of the adjustable front clamping type, it is provided with right and left hand power feeds. The front clamp is hydraulically operated. The machine excels for cropping the ends of billets and tubing. The operating controls are grouped on the front panel for ease of operation.

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Penton Building • • Cleveland, Ohio

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1. **Hand screw adjustment of vertical vise jaw.**
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3. **Power feed rollers.**
4. **Feed lever.**
5. **Start-stop push button station.**
6. **Ammeter.**
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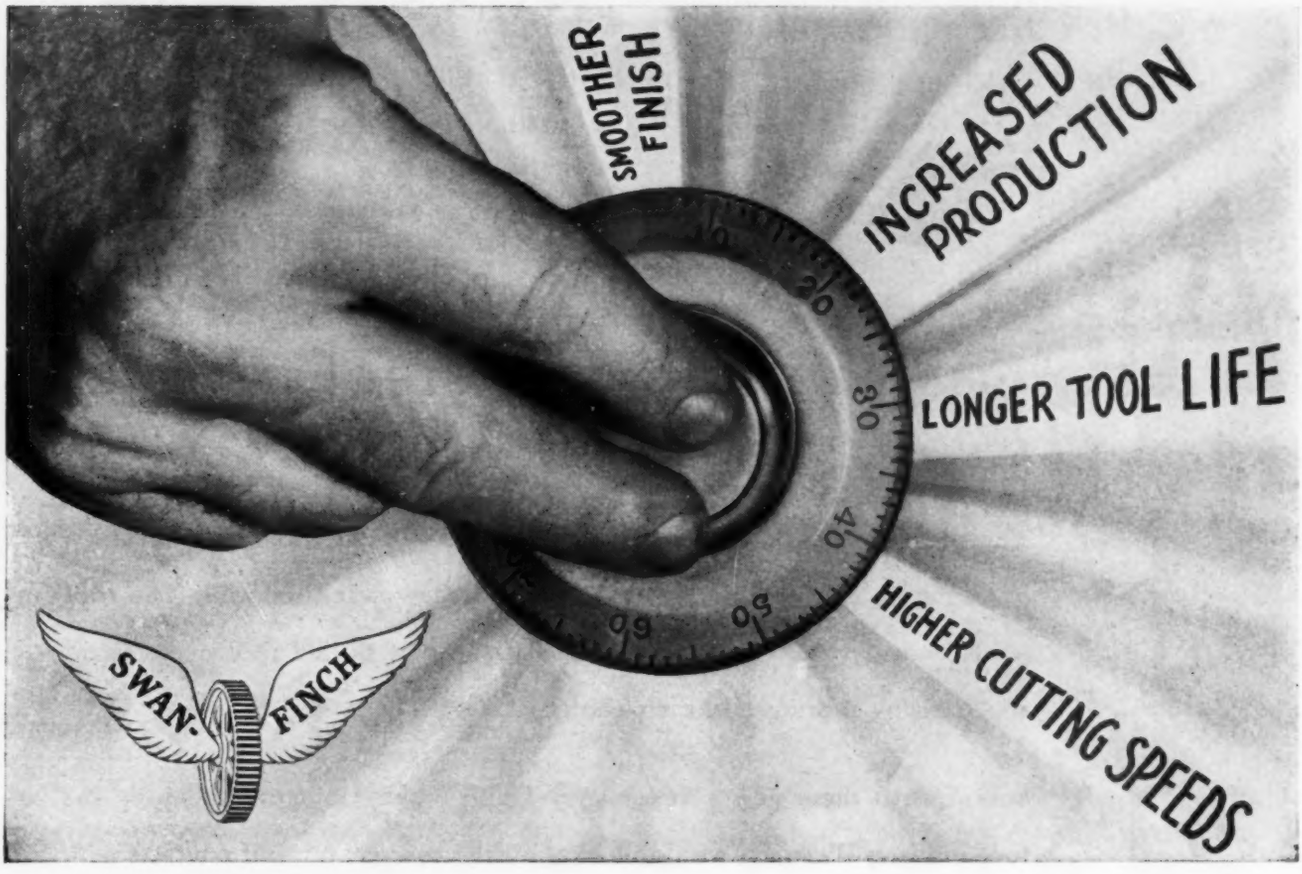
8. **Pressure gauge.**
9. **Control lever for clamping and operating power roller.**
10. **Coolant flow control.**
11. **Power roller reversing switch.**
12. **Automatic lifting mechanism for power roller.**
13. **Coolant pump chamber.**
14. **Hydraulic pump chamber.**

Built by **MOTCH & MERRYWEATHER**

MOTCH AND MERRYWEATHER THE MACHINERY CO
CLEVELAND DETROIT CINCINNATI PITTSBURGH



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Right Combinations for increased production!

Right combinations of ingredients in metal working lubricants are like the right numbers on the dial of a safe, each one vital for opening wide the doors of production.

Swan-Finch 'SAFCO' metal working lubricants are combinations that have been continuously proved as scientifically correct.

Today high production schedules and precision specifications do not permit guesswork.

Swan-Finch, the makers of 'SAFCO', are lubrication specialists in the metal working field.

That's why more important plants engaged in vital war production are testing and specifying 'SAFCO' lubricants.

It will pay you real dividends to get better acquainted with the Swan-Finch field representative who covers your district. Capable and able, they are constantly devising *new* ways and means for stepping up production.

For instance meet Clinton Moore. He is one of our highly trained and experienced staff of fieldmen.

ASK US TO HAVE HIM CALL—NO OBLIGATION.

SWAN-FINCH OIL CORPORATION

Offices		Plants	
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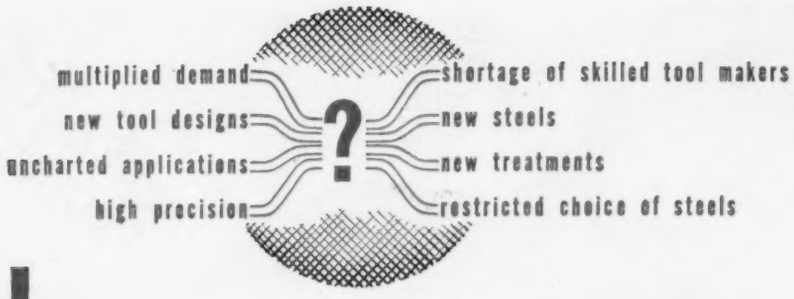
Detroit, Mich.	2596 Hart Avenue	Detroit, Mich.	2596 Hart Avenue



Aid on wartime tool steel problems

Top speed war production demands TOOLS — *more* tools than dreamed of in peace time — *new kinds* of tools for new war time jobs. The tool industry is tackling this tremendous task short of skilled tool makers and restricted by shortages in their choice of steels.

Solutions to these new problems are being worked out every day by the tool industry. Frankly, we don't have all the answers but our contacts with American tool makers determined to win this war puts us in a position to assist you in finding solutions to some of the particular problems that may be facing you.

On your problems of steel selection and treatment of tool steels, we would be very glad to have you get in touch with us. For your convenience, we are listing below the addresses of our district offices.

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COPPCO TOOL STEELS

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JOHNSON BRONZE

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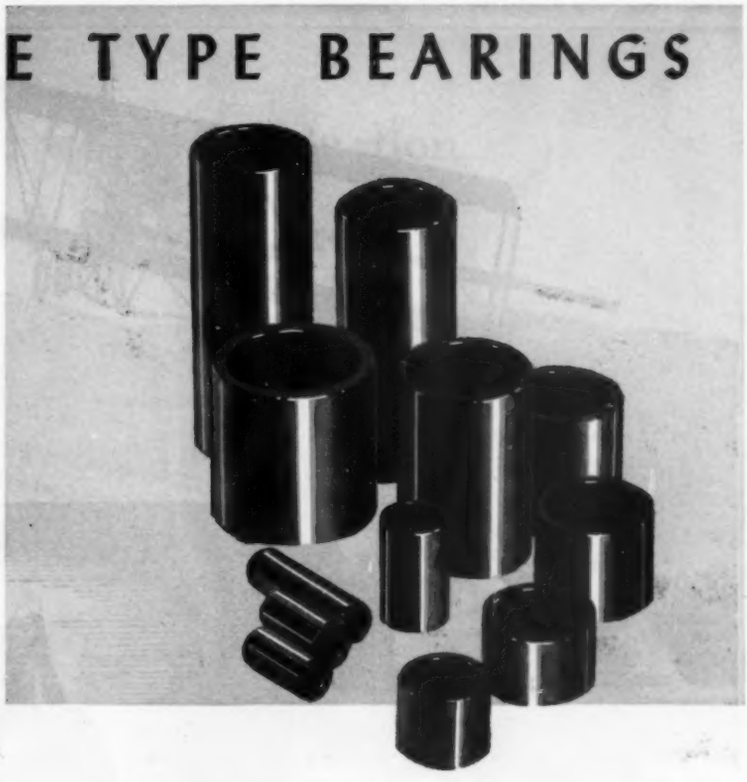

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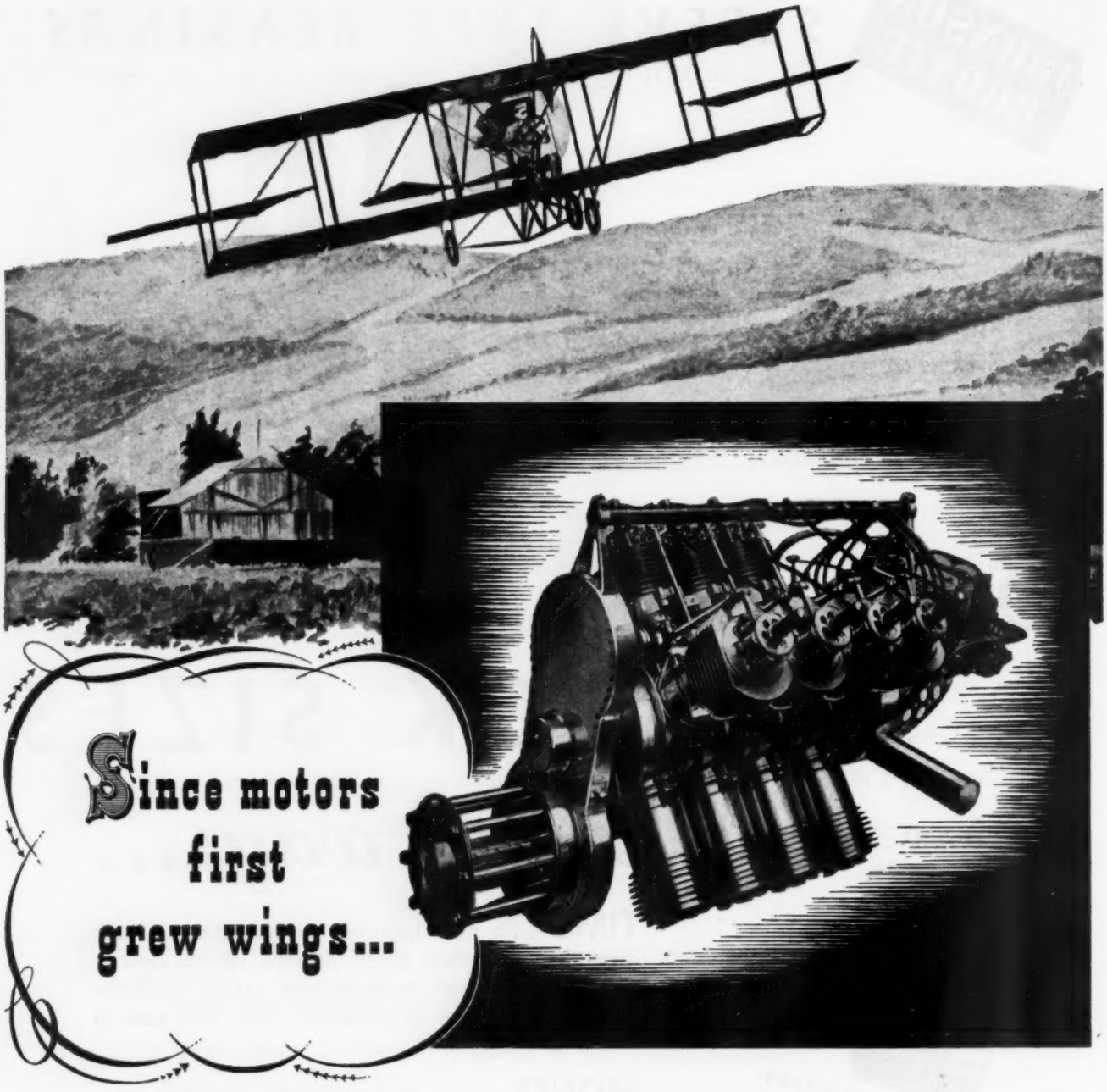

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BACK in 1911, Taft-Peirce produced the original Lougheed motor. Then, later on, Taft-Peirce tooled the motors which flew Lindbergh to France, Byrd to the poles . . . and many other famous names and planes to new records for speed and endurance.

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TAFT-PEIRCE

★ *Serves the Aviation Industry* ★

With Tooling . . . Special Production . . . Standard Air Service Equipment

Are any of **your** production problems included here?

The proper Gulf product may be the answer

How to get increased output from machine tools How to conserve critically scarce tool steels	**GULF CUTTING OILS** combine the best possible lubrication and effective cooling—increased production and lengthened tool life in many cases are truly remarkable
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IF you have a problem in any way connected with the use of a petroleum product, Gulf is well prepared to give you effective help in finding the answer. For the Gulf organization combines petroleum manufacturing knowledge and skill with broad practical experience in the varied production and maintenance problems of industry.

Call in a Gulf service engineer today and get the benefit of his helpful counsel. His recommendations may enable you to improve production — both in quality and quantity — and reduce manufacturing costs.

The services of a Gulf engineer—and the Gulf line of quality petroleum products — are available to you through more than 1200 warehouses located in 30 states from Maine to New Mexico. Write or 'phone your nearest Gulf office today.

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CALL IN A GULF SERVICE ENGINEER TO HELP STEP UP PRODUCTION—

Here's how it works! With P&H-Hansen Square Frame Welders mounted as dual units, you have *two* separate services of from 30 to 260 amps. each. *Two* operators can weld with 5/32" or 3/16" electrodes. For peak loads, simply hook the two machines in parallel and have their combined capacity for *one* operator.

Yet, whether you operate machines singly or in parallel, you make but one simple current adjustment. Arc response is automatic on all types of work. You can't go wrong. That's what makes P&H-Hansen the only true welding generator on the market — why you can't beat it for economy — and efficiency. Write for Bulletin W-26.

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Awarded the Navy "E" for excellence in war production, P&H displays it also as a pledge of future effort.

P&H FOR ALLOY ELECTRODES

P&H offers electrodes for practically every need — in welding stainless, for hard surfacing, resistance to impact and abrasion, as well as special types for welding cast and rolled armor plate, for building up cutting tools, etc. P&H engineers will gladly advise you on methods and procedures. Write us.

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Canadian Distribution: **The Canadian Fairbanks-Morse Co., Ltd.**

Return Scrap Tools and "Keep 'Em Flying"

1. Return the broken and worn-out high speed steel tools to the steel furnaces. Here they can again be turned into steel bars and later be made available to you in the form of new tools.

2. To "Keep 'Em Flying", your plant must be kept running to full capacity. Be sure the high speed steel drills and reamers you are using are correctly pointed and sharpened as this will prolong their life and increase your production.

W&B

TWIST DRILLS
REAMERS
SPECIAL
TOOLS

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Write for booklet entitled "Drill and Reamer Facts," which gives pertinent information on design, use and care of drills and reamers.

WHITMAN & BARNES
NEW YORK DETROIT CHICAGO

"Makers of Fine Tools Since 1854"

MICRO-PLATE

(PATENT PENDING)

An Amazing New Service for War Industries

ENDORSED BY W. P. B.

Parts showing application of MICRO-PLATING and SPOT-PLATING

Micro-plating builds up worn or deficient areas *only*—with chromium or other metal. Thus, applying metal only where needed,

- . . . ***saves expense and scarce materials;***
- . . . ***prevents idle machine time, because it***
- . . . ***eliminates unnecessary re-machining;***
- . . . ***prolongs or renews life of expensive tools;***
- . . . ***reclaims defective new parts;***
- . . . ***salvages old, worn parts. Has innumerable uses.***

Applicable to the smallest parts as well as to large surfaces, internal or external, in thicknesses from .00001 upward.

SPECIAL NOTE

If you send a small part we will be glad to Micro-Plate it for you without cost as a demonstration of this new process.

A telegram, phone call or letter will immediately bring you descriptive folder and full information.

INDUSTRIAL CHROMIUM CORP.

Micro-Plate Dept. 10

HOLYOKE - - - MASSACHUSETTS

Protect Dead Centers with DIXON'S LATHE CENTER GRAPHITE LUBRICANT

HERE, AT LAST, is a lubricant compounded especially to protect the dead centers of lathes. It is a combination of pure flake graphite and ingredients made to withstand the extremely high pressures developed at the dead center in lathe work.

Dixon's Lathe Center Lubricant prevents overheating and assures effective protection against wearing, scoring and softening. Eliminates shut-downs and reduces work spoilage.

Use Dixon's Lathe Center Lubricant in other applications wherever extreme film-strength is required. Now obtainable from distributors in 1, 4 and 8 ounce collapsible tubes.

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I am interested in trying DIXON'S LATHE CENTER GRAPHITE LUBRICANT.
My Supply Houses are:

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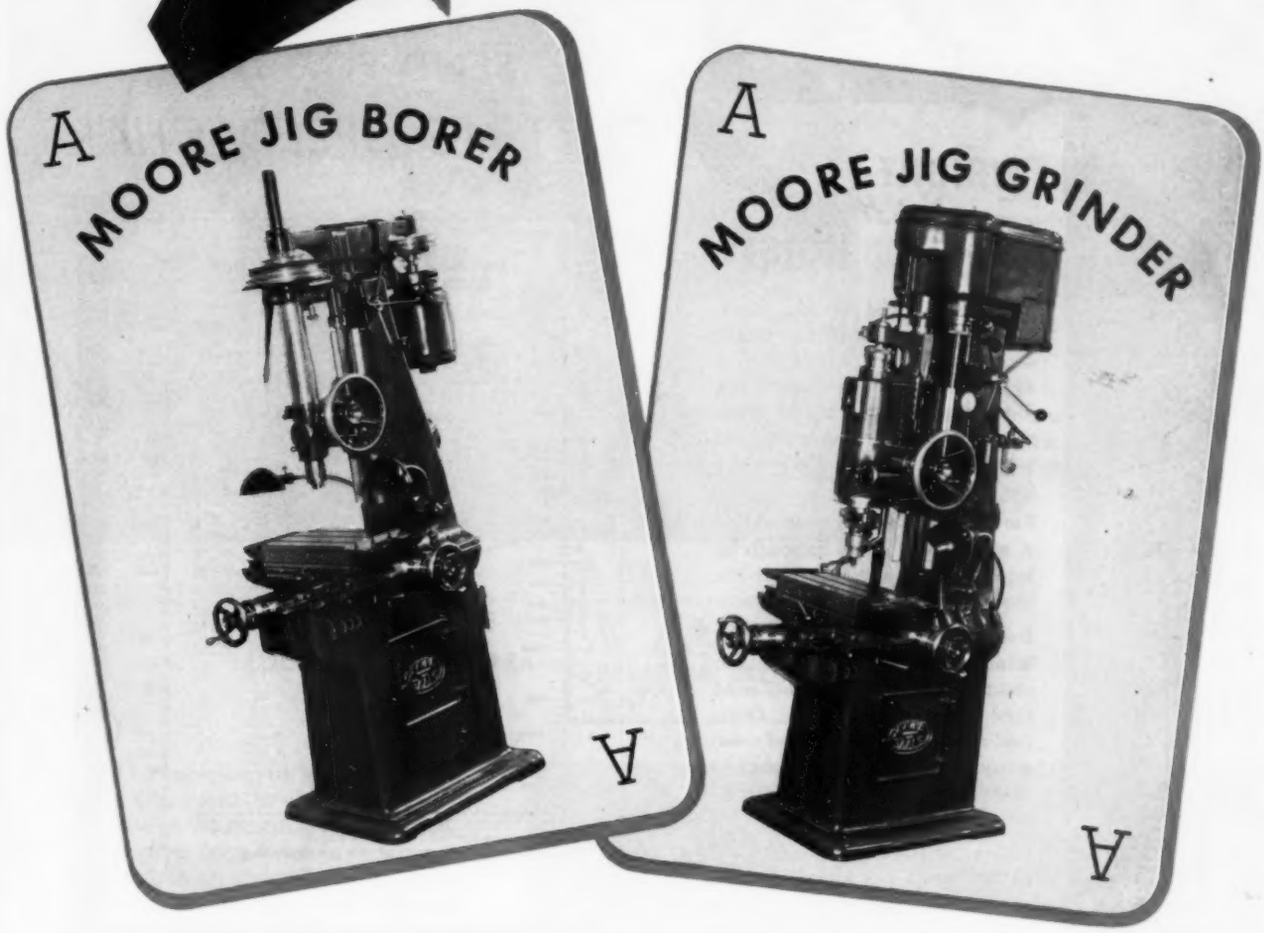
Ticonderoga Graphite • No. 635 Graphite • Microfyne Graphite • Pipe Joint Compound • Graphite Seal • Graphited Oils • Cup and Pressure Gun Grease • Gear Lubricants • Waterproof Graphited Grease • Auto-Marine Grease • Graph-Air Guns • Belt Dressing (Contains no Graphite).

3233

2 TOOLROOM ACES



● THE MOORE JIG BORER, featuring an exclusive process of coordinate location, permits accurate spotting, drilling, reaming and boring in one uninterrupted sequence. Easy to operate, this machine solves layout and jig-boring problems speedily and efficiently...produces more holes to closer tolerances in less time. Sensitive for holes of 1/32″, or smaller, and rigid for heavy cuts, it can be used for jig-less, small-lot production. The operator can set the table instantly in the desired position and check himself without fear of error.

● THE MOORE JIG GRINDER, an important contribution to the science of tool and die-making, has been developed to meet the growing need for finish-grinding holes to size and location, previously accomplished only by make-shift methods. This machine corrects and finishes jig-bored holes on both hard and soft work within .0001″. Holes can be ground straight or tapered, by hand or power feed. Multiple hole-grinding in jigs, heretofore requiring extreme skill, is performed by semi-skilled operators on the Moore Jig Grinder in one-quarter the time. Ask for full details on this ingenious machine.

● HERE'S A TOOLROOM TIP. Used in conjunction with each other, the Moore Jig Borer and the Moore Jig Grinder, like "aces back-to-back," form a perfect pair...a sure bet to produce precision work at high speed, increase die life and lower costs. *Write today for descriptive literature.*

Manufactured by MOORE SPECIAL TOOL CO · INC *Bridgeport, Conn.*

MOORE TOOLS

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WRIGHT *Improved High-Speed* HOISTS

Too often the hoist that is on stand-by duty—*"on guard"* for instant action in case of emergency—is neglected by the maintenance man. Don't neglect your hoists. Make them last longer by regular and proper maintenance. Here are a few suggestions:

Put the Grease Gun to Work!
A **WRIGHT HOIST** needs thorough lubrication once a month. Keep the load chain well-lubricated, too.

Don't Overload Your Hoist.
While **WRIGHTS** are famous for their ability to stand abuse, this is no time to abuse machinery. Overloading results in a stretched chain which cannot seat itself properly in sheave pockets, thus accelerating wear.

Watch the Load Hook.
WRIGHT hooks, drop-forged from special steel, give visible warning of overloading by slowly opening. Don't continue to use hooks that have stretched.

Inspect Your Hoists Regularly.
Where properly maintained, **WRIGHT HOISTS** have given continuous, trouble-free service for 20 to 25 years. Just to summarize—remember—

1. **Don't forget the grease gun**
2. **Don't overload your hoists**
3. **Watch the load hook**
4. **Inspect your hoists regularly**

WRIGHT MANUFACTURING DIVISION
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In Business for Your Safety

AMERICAN CHAIN & CABLE COMPANY, Inc.
BRIDGEPORT • CONNECTICUT

SCREW MACHINE

Foremen, Set-Up Men and Production Engineers

SEND FOR THIS CUTTING SPEED CHART

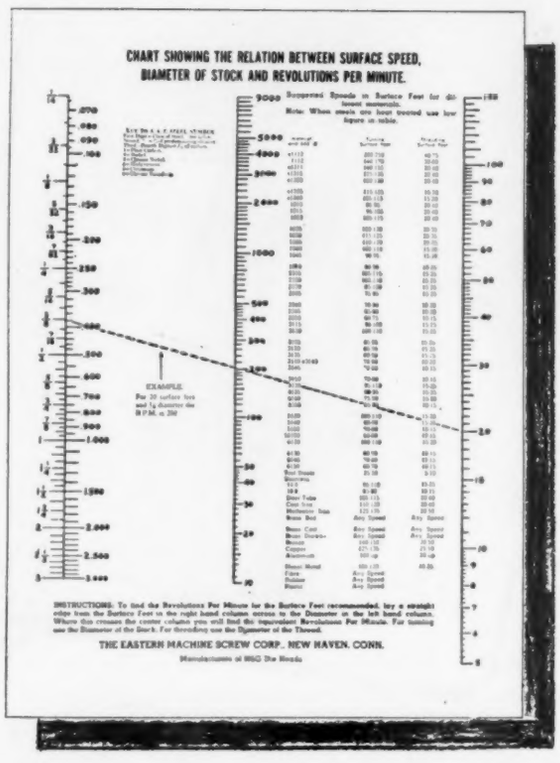
CHART SHOWING THE RELATION BETWEEN SURFACE SPEED, DIAMETER OF STOCK AND REVOLUTIONS PER MINUTE.

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FREE - *to Users of H&G Die Heads*

A simple way to find R.P.M. for proper Surface Feet for threading 70 different S.A.E. metals and materials. No figuring. Simple. Easy. Quick.

H&G DIE HEADS

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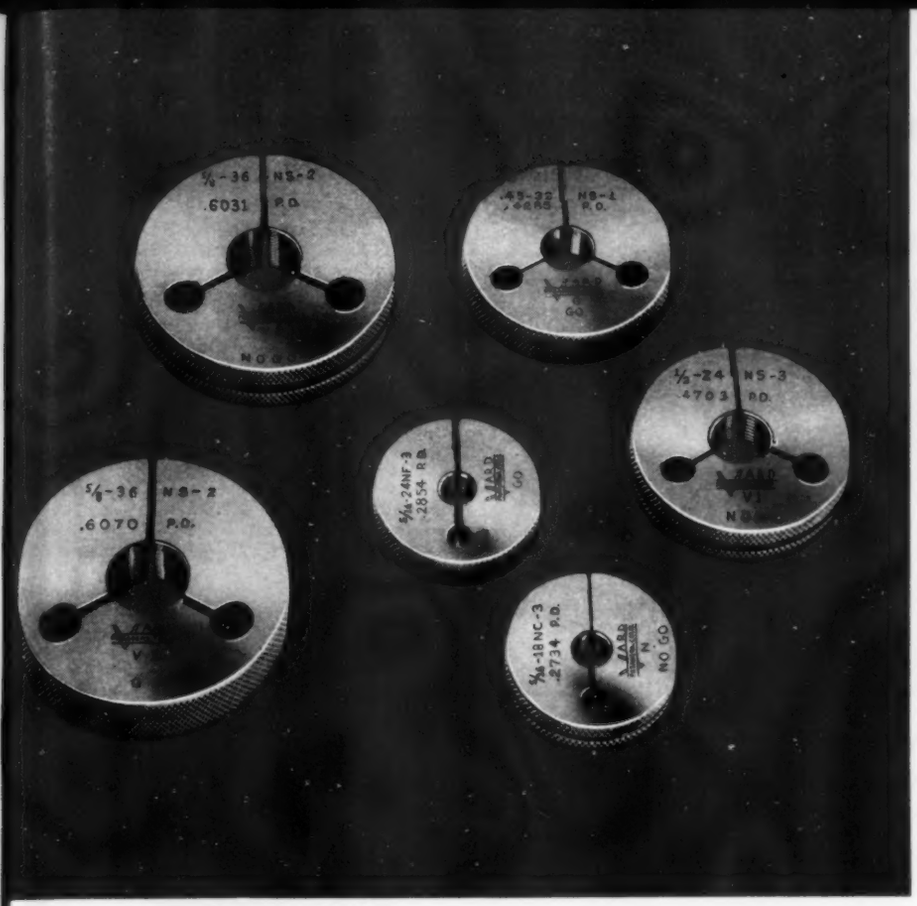


VARD

PRECISION RING GAGES

Like VARD threaded plug gages, VARD ring gages can be made at the present time in diameters up to 12-in. These precision inspection gages are made in National thread forms, metric and some special forms, other than Whitworth.

All VARD Ring Gages, unless on special order, or special blue-print design, are made to American Gage Design Standards and are adjustable.

LOOK FOR THIS MARK **VARD PASADENA, CALIF.** ***ON ALL VARD PRODUCTS!***

VARD Precision Ring Gages are made from tool steel, heat treated to a Rockwell hardness of 63 to 66. The thread forms are lapped to a high polish on special lapping machines. All Ring Gages in National Coarse and National Fine series in Class 3 fit, up to 1½-in. diameter, are set to our own setting plugs and sealed with our mark, at the factory, at no extra cost.

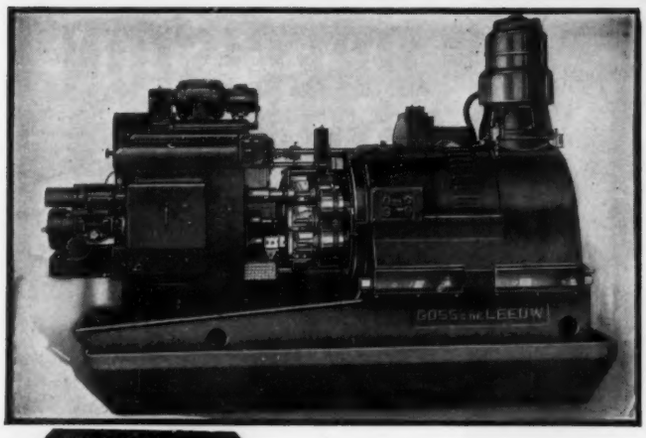
Worn Ring Gages may be returned to our factory for inspection. If practical, the gage will be reconditioned, set and sealed. Such reconditioned gages are fully as accurate as new gages.

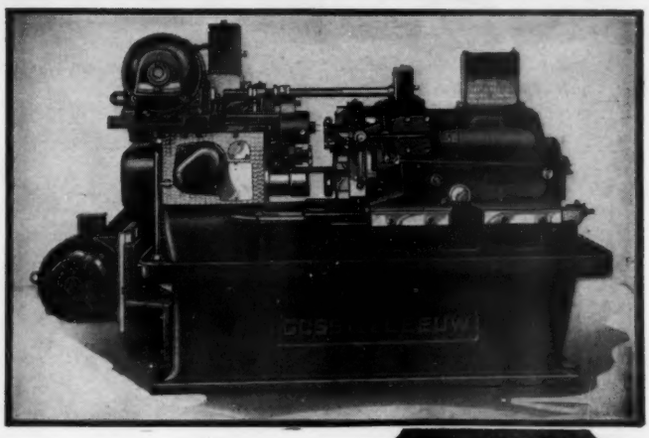
All VARD Precision Ring Gages, Size No. 10 and larger, have the first thread completely removed to avoid chipping. This feature increases ease of use and adds to the life of the gage as we have found through experience in our own plant.

VARD INC.

PASADENA, CALIFORNIA, U. S. A.

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES





WORK ROTATING TYPE
5 Spindles
6 Spindles
8 Spindles

Features include:

Lead Screw Threading on both types—Pre-loaded Anti Friction Spindle Bearings—Hardened Ways—Oversize Spindles—Gears of Chrome-nickel steel, carefully heat-treated.

Write for copy of descriptive catalog giving complete, detailed specifications.

TOOL ROTATING TYPE
4 Spindles
5 Chucking Positions

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

BUZZER

INDUSTRIAL GAS FURNACES

Just connect to gas supply
high temperatures quickly attained

An outstanding feature of "BUZZER" equipment is its ability to operate efficiently, economically and quickly on city gas without blower, power or auxiliary equipment.

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HIGH SPEED MUFFLE FURNACES (RIGHT)

These BUZZER "Super Heat" Furnaces —for heat treating high speed and alloy steels—will heat to 2400° in 1½ hours. Insulated with high grade fire brick; ruggedly constructed; full muffle design. Quiet, efficient, economical, protective atmosphere.

ATMOSPHERIC POT FURNACES (LEFT)

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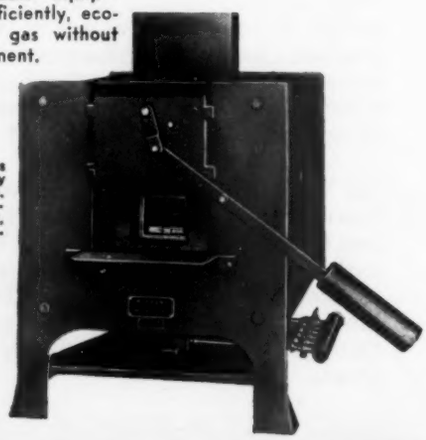

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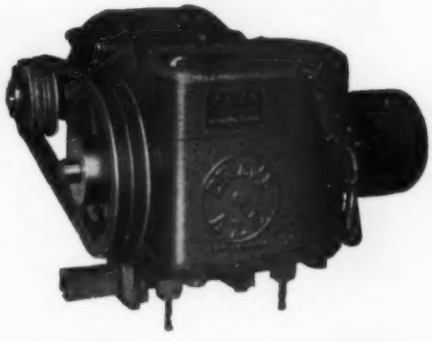
"With DRIVE-ALL Units We Gain Power, Speed, Economy and Shop Flexibility"

"The belt driven machines rebuilt in the Acme plant are converted to motor driven machines with modern Drive-All selective speed transmissions. A motorized machine, manufacturers have learned, is not only capable of more speed and power but is also more economical to operate and can be moved from one department to another or from one plant to another. With motor drive attached all machines are tested under power and given a thorough final inspection in the Acme plant before shipment.

This meets the need for a conservation of material, increased production, greater flexibility of shop equipment and a greater usability of rented floor space.

ACME EQUIPMENT CO.
128 S. Clinton St., Chicago, Illinois
by F. J. Quertermus

There are standard Drive-All selective speed motorizing units for application on all belt-driven machines. 1 to 10 H.P. in either 3- or 4-speed models. Can be mounted on an average machine in about two hours' time. All models also available with clutch and with right or left hand output. Variety of standard mounting brackets save installation time and provide simple belt adjustments.



☐ LATHES AND TURRET LATHES

☐ MILLING MACHINES

☐ GEAR CUTTERS

☐ DRILL PRESSES AND RADIALS

☐ AUTOMATICS

☐ ☐ SHAPERS AND PLANERS

☐ TAPPERS

☐ BORING MILLS

☐ SPECIAL APPLICATIONS

Write for Catalog.

New England branch:
187 Dartmouth Street
Boston, Massachusetts

Chicago branch:
30 N. La Salle Street
Chicago, Illinois

Buffalo branch:
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Buffalo, New York

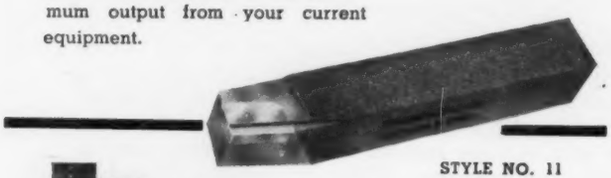
(Also Dealers in Principal Cities)

DRIVE-ALL

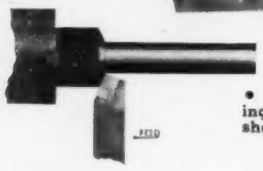
KENNAMETAL*— The Sensational Cutting Tool of *World War II*

KENNAMETAL THE All American CARBIDE

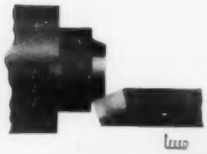
• Illustrations below show the correct applications of the most widely used styles of KENNAMETAL Carbide Tools. Standardize on these ruggedly designed KENNAMETAL tools and get maximum output from your current equipment.



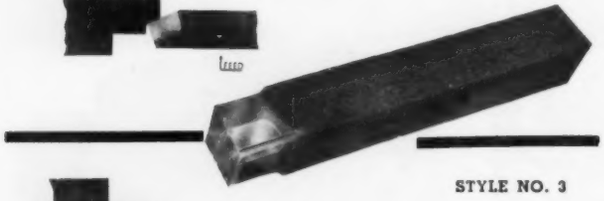
STYLE NO. 11



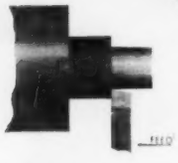
• Style 11 is for rough turning or where a square shoulder is not required.



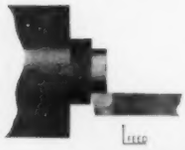
• Style 12 is for rough facing or large boring, where a square shoulder is not required.



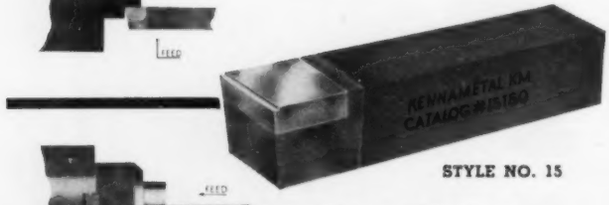
STYLE NO. 3



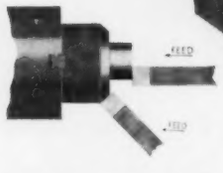
• Style 3 is for turning to a square shoulder.



• Style 6 is for facing or large boring to a square shoulder.



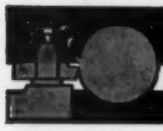
STYLE NO. 15



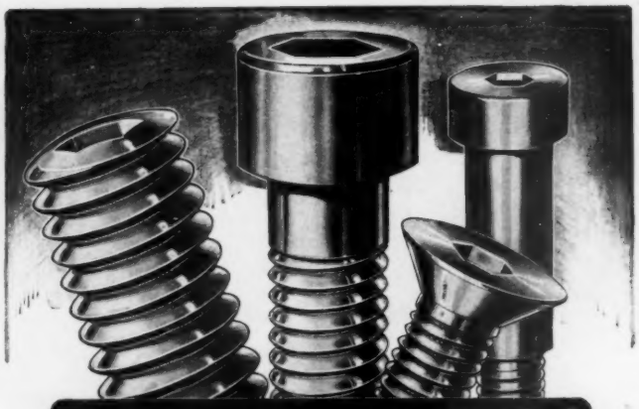
• Style 15 is for facing and chamfering, or may be used for turning or facing.

• For greater production on your boring, turning, and facing operations use KENNAMETAL tools.

Write for the Vest Pocket Manual which gives complete information about this superior cutting carbide.



McKENNA METALS Co.
103 LLOYD AVE., LATROBE, PA.
Foreign Sales: U. S. STEEL EXPORT CO., 30 Church St., New York
Exclusive in Canada and Great Britain



ALLENS' QUALITY PERSISTS

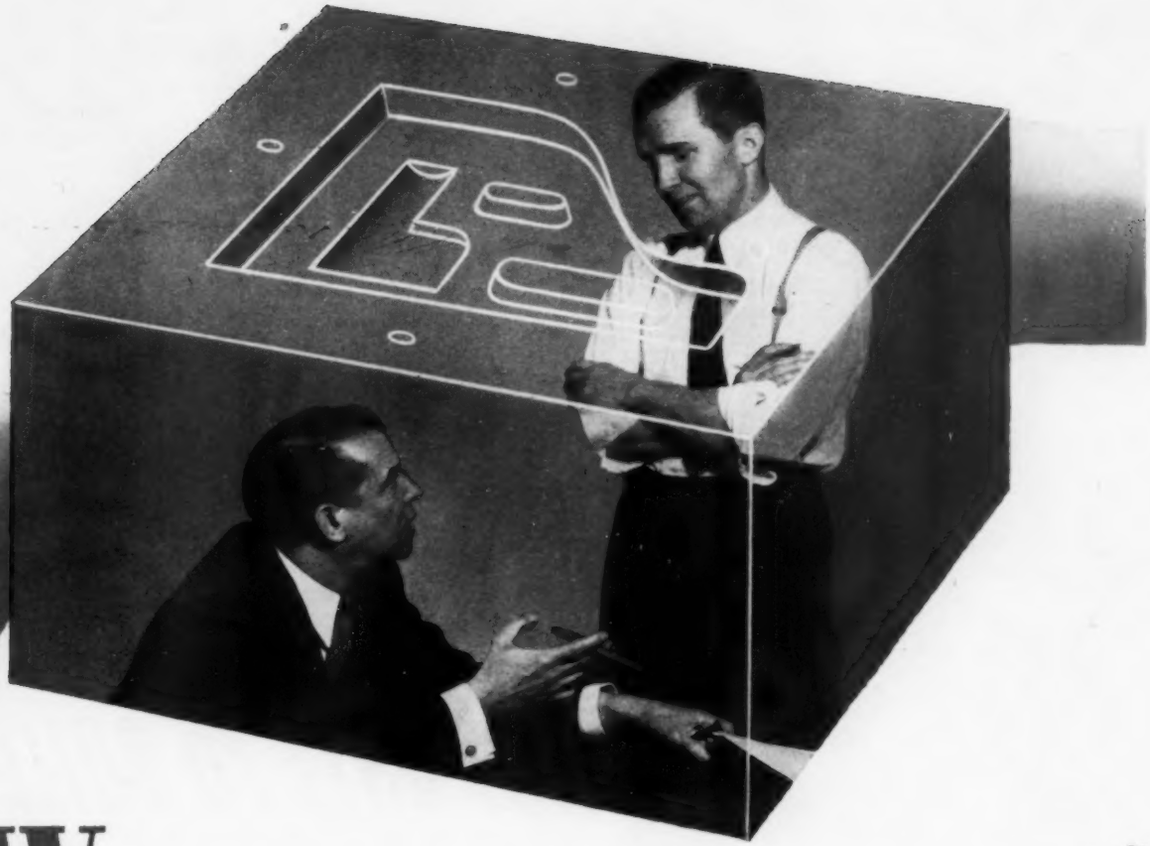
IT STAYS on the level of our all-time *high* in strength of material, thoroughness of heat-treating, accuracy of threading. Not one characteristic of Allen screws has changed except for the better.

Production-gains have *all* been scored by improved manufacturing processes; not in a single case by cheapening the product.

Step-by-step inspection standards have been *more* intensively applied, not less. So that everything "Allens" have had they have NOW. And every quality that's won your preference will continue to *hold* it.

Order only through your local Allen Distributor — the man who gets you the goods to the LIMIT of the supply!

THE ALLEN MFG. COMPANY
HARTFORD, CONNECTICUT, U. S. A.



"We need more production... per die"

... and LATROBE helped increase output as much as 300%

A large user of die steels, had been using a steel of a particular analysis which for years had given good performance. Yet production had to be increased!

Latrobe's trained metallurgical staff was called upon to provide a solution. Many factors had to be considered, such as toughness, deformation in heat treatment, ductility possible with high hardness, etc. The answer required diligent application, exhaustive study, patient research.

But the result proved the worth of *Latrobe Metallurgical Service*, for production per die was increased *as much as 300%*.

This is a war of METALS

It calls for conservation and replacement of critical metals. It presents new problems in selection, application and handling of tool steels. You'll find Latrobe Metallurgical Service a vital wartime aid in such cases...we'll gladly help you without obligation!

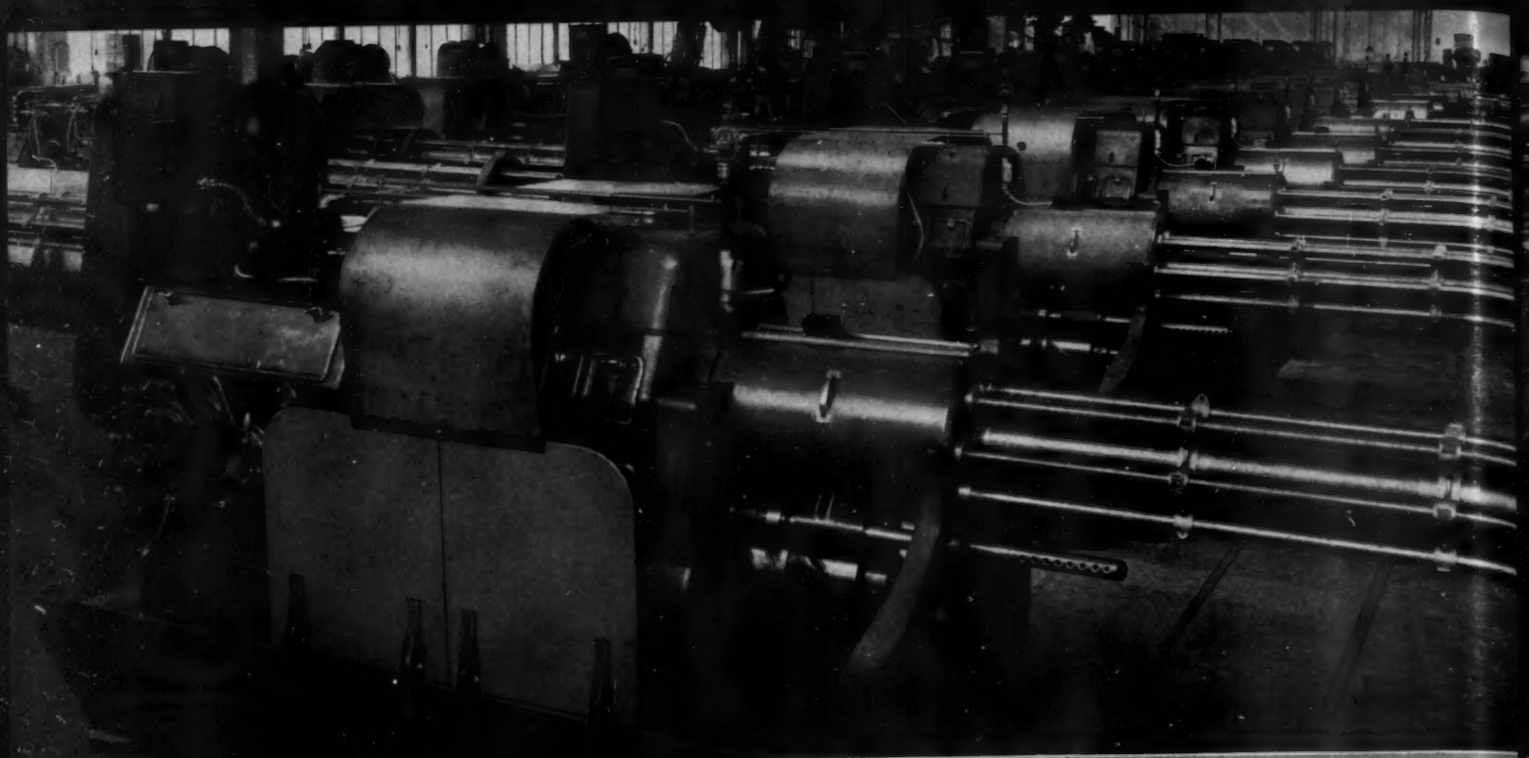
LATROBE

Metallurgical Service

Latrobe ELECTRIC STEEL COMPANY

LESCO

MAIN OFFICES *and* PLANT • LATROBE · PENNSYLVANIA



NOT ONLY TO BUILD WELL - BU

THE NATIONAL ACME CO

170 EAST 131st STREET • CLEVELAND, OHIO

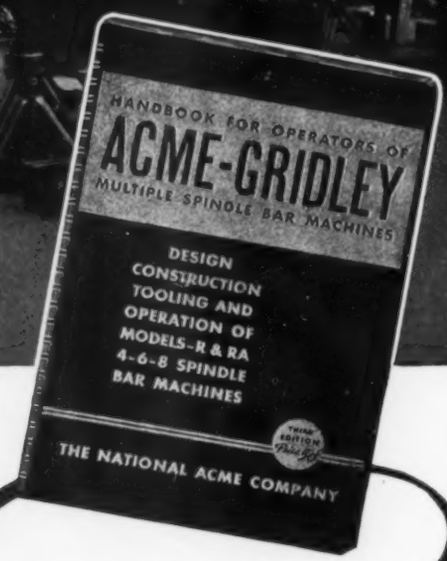
ACME-GRIDLEY 4-, 6- AND 8-SPINDLE BAR AND CHUCKING AUTOMATICS • SINGLE SPINDLE AUTOMATIC [illegible] AUTOMATIC THREADING DIES AND CAPS • SCREW MACHINE PRODUCTS • THE CHRONALOG • LIMIT SWITCHES • SOLENOIDS • POSITIVE CLU[illegible] • CONTRACT MANUFACTURING

...BUT TO HELP YOU GET *Peak Output!*

As battery after battery of these peak production Munition Automatics go into action, thousands of new operators must be trained. It is our job to help these men gain time on every Acme-Gridley fighting front. So —

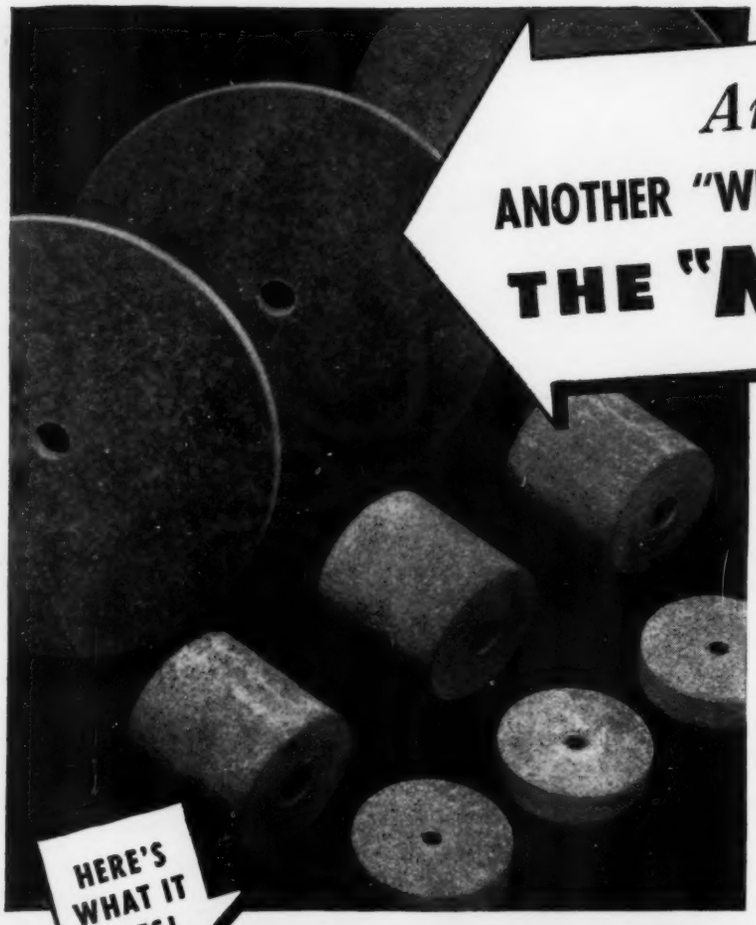
Here is a valuable book — FREE under these conditions:

1. It covers only Models R and RA Acme-Gridley Bar Automatics — is not useful for earlier models (A, C, F, G, H machines) for which no books are available.
2. Give name of company, model and size of machine on which you are actually working — such as R-1¼", RA-1⅝". This is essential.
3. Due to the limited supply of these books we are obliged to adhere strictly to the above conditions.



124 pages, over 100 illustrations, prepared by our own operators — men who know Acme-Gridley Munition Automatics from A to Z.

Read conditions at left before writing.



Announcing

ANOTHER "WEAPON FOR PRODUCTION"

THE "MX" WHEEL

Pioneered and offered to industry exclusively by Carborundum

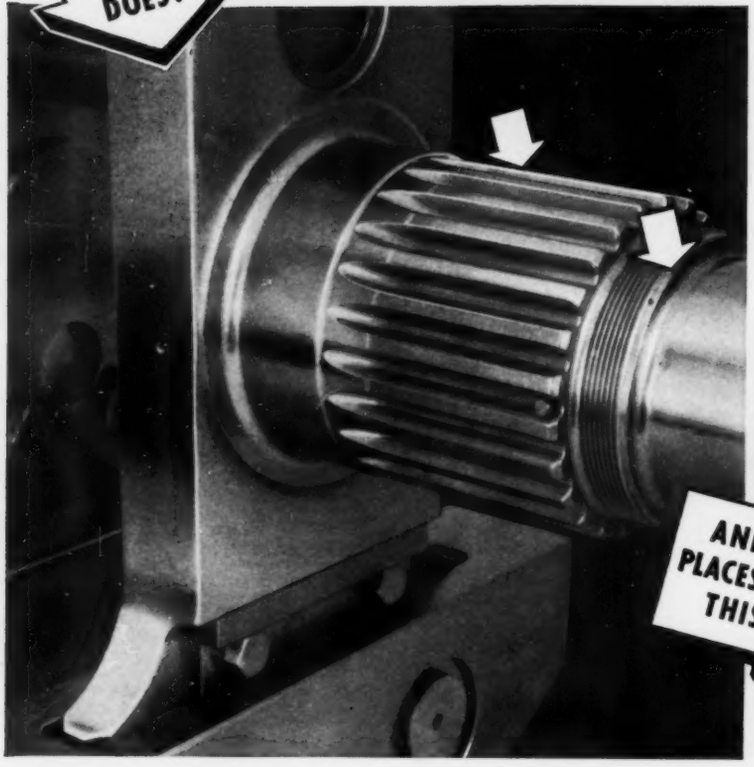
LESS than a year old, the "MX" Wheel is already making a name for itself as a "Weapon for Production." It is a free-cutting wheel capable of light stock removal and high polishing action at the same time. It requires but little pressure. It is used dry, since no coolant is required at the low cutting temperature developed. And its flexibility adapts it particularly for use in finishing and polishing out-of-the-way places on airplane engine parts and similar work.

Some typical applications are indicated by arrows on photos below. They include breaking down burrs or sharp edges on gear teeth, finishing and polishing splines and hard-to-get-at flat surfaces, depressed areas and various types of undercuts.

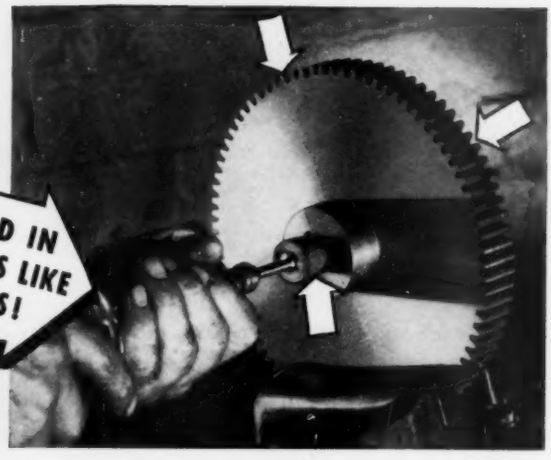
These new wheels are so fabricated as to give variable degrees of resiliency and flexibility, in six grades of hardness. They are made in grits 50, 80, 120, 180 and 320. Diameters range from 1" to 12", and thicknesses from $\frac{1}{16}$" to 3". More complete information on request.

CARBORUNDUM
ABRASIVE PRODUCTS

HERE'S WHAT IT DOES!



AND IN PLACES LIKE THIS!



THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

REG. U. S. PAT. OFF.

Sales Offices and Warehouses in New York, Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh, Cincinnati, Grand Rapids

(Carborundum and Aloxite are registered trade-marks and MX is a trade-mark of, and indicate manufacture by The Carborundum Company)

No. 2

American
PLAIN MILLING MACHINE . . .
featuring

Infinite Spindle Speeds
Standardized Spindle Nose
Motor-in-base Drive
Heavy Rugged Construction

PROMPT DELIVERIES WITH HIGH PRIORITIES

Specifications

TABLE—Working surface: 46" x 10½"
T-slots—Three; ⅝"

RANGE—Longitudinal, power feed: 25"
Transverse, power feed: 9"
Vertical, hand feed: 19"

SPINDLE—Standardized flange spindle nose: No. 40 taper
Hole through spindle (diam.): 21/32
Speeds—(number): Infinite
Speeds—(range): 25-500 R.P.M.

FEEDS—Number (geared): 16
Range per revolution: .005" to .212"

FLOOR SPACE—85" x 68"

FEATURES

★ **SPINDLE** Heat treated chrome-nickel steel accurately ground to size; standardized flanged spindle nose with number 40 taper. Spindle runs in heavy phosphor bronze bearings compensated for wear and equipped with Alemite lubrication fittings.

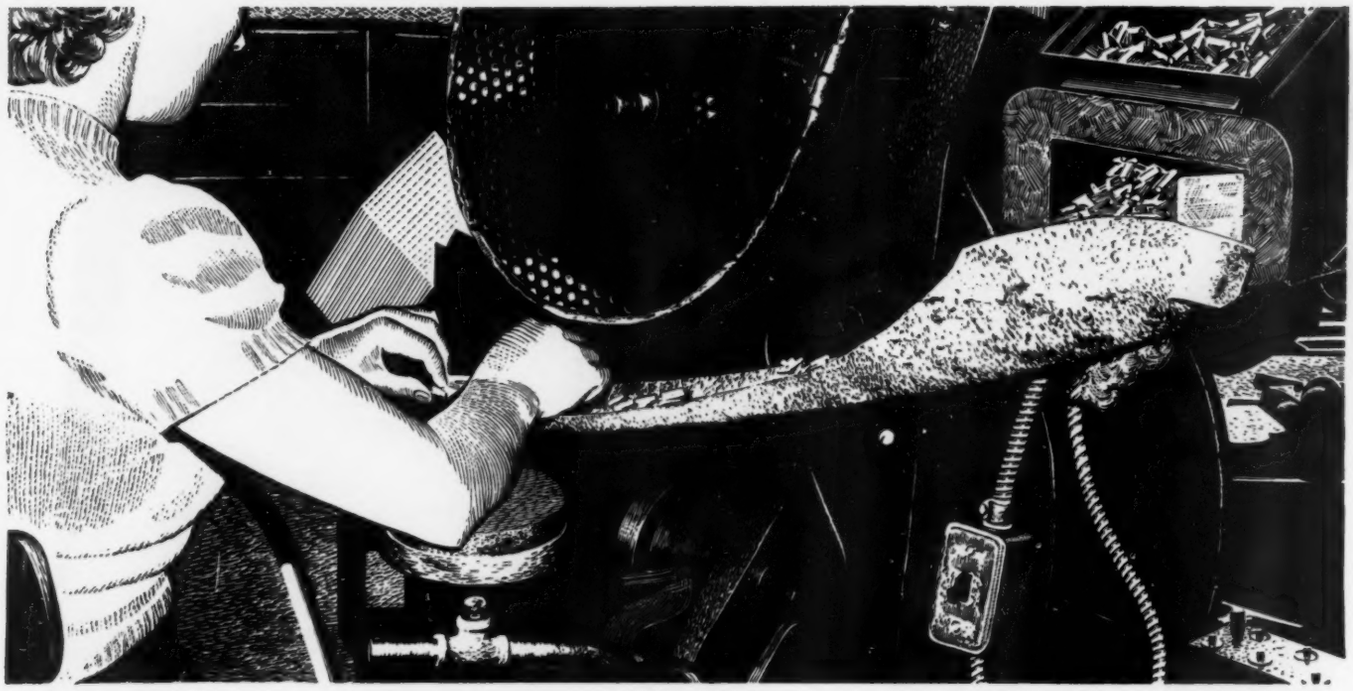
★ **DRIVE** U. S. Vari-Drive Motor, ball bearing throughout, is mounted in base. Infinite variations in speed can be obtained instantly with machine in operation by means of a single, direct reading dial control within easy reach of operator; multiple vee belt drive to spindle through TWIN-DISC Duplex Machine Tool Clutch.

★ **CONTROLS** Speed and feed changes, push button control and clutch lever located centrally for ease and convenience of operation with minimum effort.

★ **TABLE** Designed for maximum service life and maintained shape and alignment. Working surface has generous oil pockets and three tee-slots. Table provided with both longitudinal and power traverse feeds.

Write for Descriptive Bulletin giving full information

J. L. LUCAS & SON, Inc.
BRIDGEPORT, CONN., U. S. A.



How Sally used up a copper mine

LOOK at the picture carefully. See that elbow-rest under Sally's arm?

It is significant. In fact, it's a humble sermon on war production.

Understand the existence of that arm-rest and you understand one of the basic reasons why, in less than seven months after war-conversion, American industry is hollering for Washington to provide more copper and other basic raw materials.

► Before Sally got her arm-rest, she reached over to a box, picked up a tiny part for an airplane instrument and placed it in the machine . . . Now the supply box is tilted and constantly jiggled, so that the parts flow to her finger-tips. With each motion Sally saves a fraction of an ounce of energy and half a second of time.

Without such tiny savings of time and effort, America's 20,000,000 factory workers would be hopelessly handicapped in their race against the millions at work with a head-start of years in Germany, Japan and Italy.

► The muscle-misers and second-savers of our factories come in handy in this war, when splitting seconds in production is as important as it is in battle.

Who are the men that provide the arm-rests, jiggle the supply-boxes, conduct the ceaseless hunt for wasted half-seconds and needless human motion?

► They are the "methods" men of industry. They have all sorts of titles: plant managers, operations managers, methods engineers, efficiency engineers, etc. But their job is "to manage men and machines to save time and materials."

In peace, these men were the core of the industrial system that gave you the world's highest living standard at the world's lowest cost in hours of work.

► In war, these same "methods-managers," with the intelligent cooperation of American workmen, are cutting years from our arming task by splitting seconds from its millions of individual operations. This example of time-saving is just an indicator of what a plant operating man does. Such men have many other jobs, including the important job of plant maintenance, but "second-splitting" is the field in which they are the envy of the whole world.

The American Production Manager is the product of the American industrial system. Complex, loose-jointed and aimless though our system may seem to the theorist, it meets every challenge, because it is the best system ever devised by man for discovering, developing and rewarding individual initiative.

Reprints of this advertisement are available in handy booklet form.

McGRAW-HILL PUBLISHING COMPANY, Inc.

330 WEST 42ND STREET . . NEW YORK

SALLY—

IS UP YOUR ALLEY!

WASHINGTON, and other large city newspapers were used for the advertisement shown opposite, because government and public need to understand the asset which America has in its trained industrial staffs.

Read what we said about "methods management" in the advertisement, then ask yourself the secret of American genius for production economies in men, materials and time.

One big advantage we have in this country is the interchange of know-how between industries. If an instrument maker reduces a fourth-class hand motion to third-class, all other managers of small part assembly can, and do, find out how it was done.

By means of the articles and advertisements in FACTORY,* a plant operations magazine, tens of thousands of plant operating men keep abreast of each new development in equipment and technique.

The magazines of the McGraw-Hill Network of Industrial Communication exist solely for swapping ideas. They are backed by the editors and engineer-correspondents, who gather information wherever it is developed, and funnel it out to the fields where it is needed.

So valuable is this interchange of technical information that many companies are surveying their organizations to make sure that the supply of Industrial Magazines is adequate.

If you would like suggestions as to how to conduct such a survey, just write to Reading Counselor Department, McGraw-Hill Publishing Company, Inc., 330 West 42nd Street, New York.

* * *

THE McGRAW-HILL NETWORK

23 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents... More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

THE McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL PUBLISHING COMPANY, Inc.
330 WEST 42nd STREET • NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

*Factory Management & Maintenance—*SHOWS HOW TO MANAGE MEN AND MACHINES TO SAVE TIME AND MATERIALS*

American Machinist
Aviation
Bus Transportation
Business Week
Chemical & Metallurgical Engineering
Coal Age
Construction Methods
Electrical Contracting
Electrical Merchandising
Electrical West
Electrical World
Electronics
Engineering & Mining Journal
E. & M. J. Metal and Mineral Markets
Engineering News-Record
Food Industries
Mill Supplies
Power
Product Engineering
Textile World
Transit Journal
Wholesaler's Salesman

ALSO AFFILIATED WITH BUSINESS PUBLISHERS INTERNATIONAL CORPORATION, PUBLISHERS OF BUSINESS AND TECHNICAL MAGAZINES FOR OVERSEAS CIRCULATION

TO CHEW UP THE AXIS

Perkins Precision, Custom-Cut Gears are helping to power planes, tanks and other tools for victory.

Perkins Gears meet Government specifications in every respect, because this organization has the engineering ability and the equipment necessary to meet the high standards set by the Government.

If you need precision gears in your production or are designing armament which would be improved by the use of precision gears, consult with our engineering staff.

PERKINS MAKES

BEVEL GEARS — RATCHETS
WORM GEARS — SPUR GEARS
HELICAL GEARS — SPIRAL GEARS
GROUND THREAD WORMS

PERKINS
MACHINE & GEAR CO.
Springfield, Massachusetts

GRANT GEARS

"64 YEARS" MANUFACTURING GEARS

Despite the continued growth of our gear business we are still in position to give each customer the attention they have a right to expect.

We carry a complete stock of standard cut gears and can furnish special gears to your specifications.

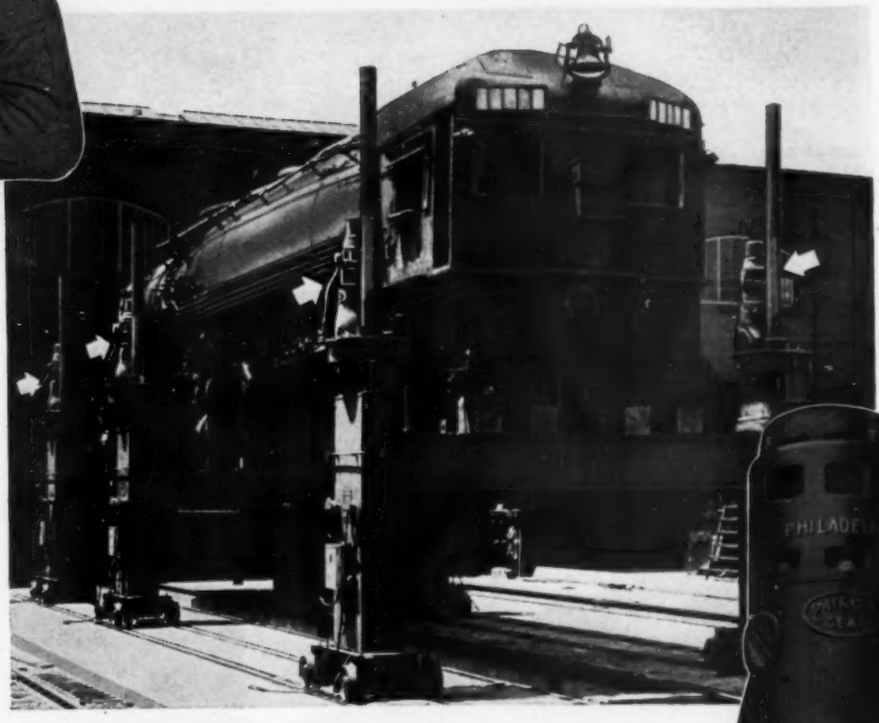
ESTABLISHED 1877
GRANT GEAR WORKS
BOSTON, MASS.
BY GEO. B. GRANT

Although we are making many times as many gears in 1942 as we did in '41 . . . you'll find no let down in Cincinnati Gear precision . . . performance or quality.

It's our job to make gears . . . it's the job we know best. This statement is being proved in hundreds of plants in production for victory.

THE CINCINNATI GEAR COMPANY
"Gears" . . . Good Gears Only"
1825 Reading Road • Cincinnati, Ohio

MOTOREDUCERS are helping to keep America's Rolling Stock Rolling



Illustrated is a pitless type locomotive hoist built by Whiting Corporation and installed at the repair shops of one of the country's largest railroads. The total capacity of its six jacks is 460 tons. Each end pair of jacks will lift 130 tons while the center pair will handle 200 tons. On each jack a Philadelphia MotoReduceR supplies the lifting power.

"Visit Us at the Power Show— Booth No. 516"

A vertical type MotoReduceR

To perform the great wartime job of transporting men and materials which our railroads are doing so ably, locomotives and cars have to be maintained in top working order, yet the time they are out of service for repairs or check-ups must be held to a minimum. Equipment used in repair shops must be dependable and efficient, so for that reason we are justly proud that Philadelphia MotoReduceRs were chosen to operate this huge locomotive hoist.

Philadelphia MotoReduceRs are driving practically all kinds of equipment in industrial plants, operating with high efficiency (up to 97%) and freedom from maintenance troubles. Made in both horizontal and vertical types and in a wide range of ratios and horsepowers they are the ideal answer where a self-contained drive is needed. Write today for more details.

★
A.G.M.A.
STANDARD
OUTPUT SPEEDS

PHILADELPHIA GEAR WORKS

INDUSTRIAL GEARS AND SPEED REDUCERS LIMITORQUE VALVE CONTROLS

ERIE AVENUE & G STREET PHILADELPHIA, PA.
New York, Pittsburgh, Chicago

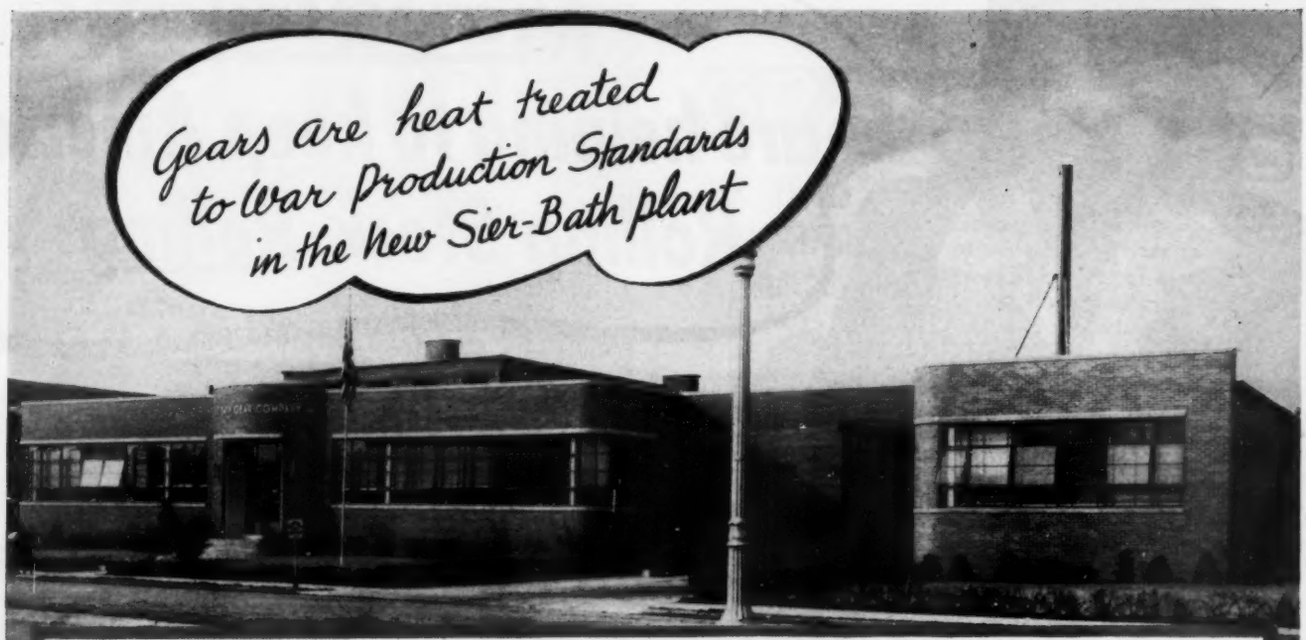
***Philadelphia* LIMITORQUE CONTROL** operates all types of valves, etc., safely, economically, from convenient stations.

***Philadelphia* GEARS** All types and sizes of industrial gears. Can be supplied in all materials.

***Philadelphia* WORM GEAR SPEED REDUCER** right angle drives — vertical or horizontal. Wide range of ratios and horsepowers.

***Philadelphia* MOTOREDUCER** The economical self-contained drive. Horizontal or Vertical types — various ratios and horsepowers.

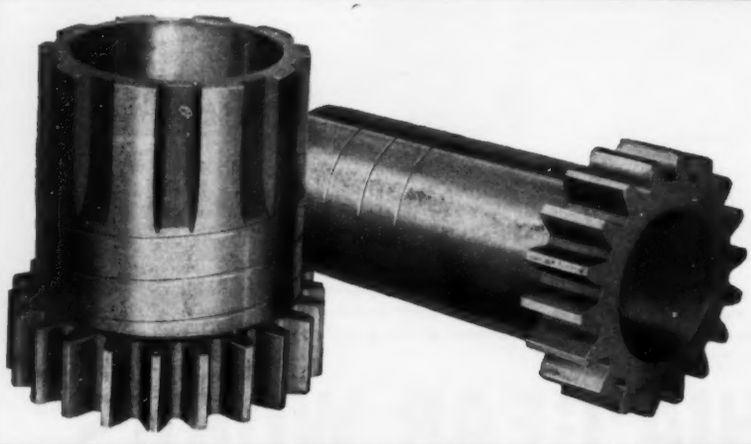
***Philadelphia* HERRINGBONE SPEED REDUCER** for heavy loads at high speed. Single, Double, Triple Reductions, various ratios and horsepowers.



Long experience as specialists in gear production has taught Sier Bath the importance of proper heat treating as a means of assuring desired and expected gear performance.

To achieve the standards in heat treating which 37 years' experience have dictated, Sier Bath operates its own heat-treating department in which every modern facility is provided for processing and control. While it actually costs more for Sier Bath to maintain this service to production, it has been found to be the soundest kind of insurance for product quality and uniformity, a fact which will be readily attested to by users of Sier Bath gears. If Sier Bath gears cost more it is only because they are better. Critical inspection quickly proves their accuracy; hard service proves their stamina.

SIER-BATH GEAR CO.
NORTH BERGEN, NEW JERSEY
Incorporated



ADAMS
GEARS

SPUR — HELICAL — WORM
BEVEL — MITER — RACKS

Splined Shafts A Specialty

THE ADAMS COMPANY
Est. 1883
1942 Bridge St. Dubuque, Iowa

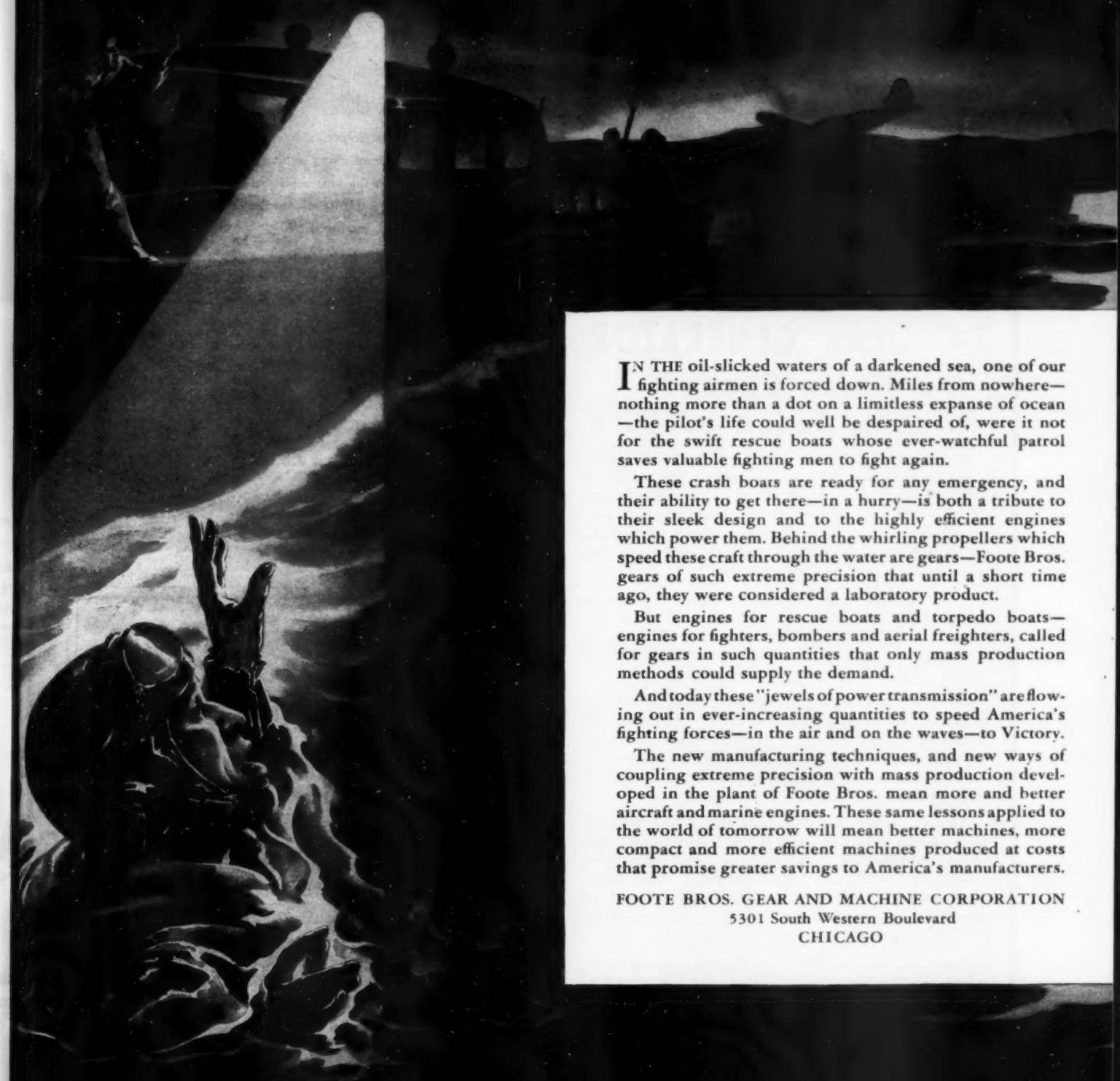
"HARTFORD"

GEARS • CAMS
THREAD GRINDING
. . . TO YOUR SPECIFICATIONS

When you come to "HARTFORD" you get what you order—without delay—at reasonable cost.
Send specifications—ask for quotations.

THE HARTFORD SPECIAL MACHINERY COMPANY
HARTFORD, CONN.

He'll live!..to fight again



IN THE oil-slicked waters of a darkened sea, one of our fighting airmen is forced down. Miles from nowhere—nothing more than a dot on a limitless expanse of ocean—the pilot's life could well be despaired of, were it not for the swift rescue boats whose ever-watchful patrol saves valuable fighting men to fight again.

These crash boats are ready for any emergency, and their ability to get there—in a hurry—is both a tribute to their sleek design and to the highly efficient engines which power them. Behind the whirling propellers which speed these craft through the water are gears—Foote Bros. gears of such extreme precision that until a short time ago, they were considered a laboratory product.

But engines for rescue boats and torpedo boats—engines for fighters, bombers and aerial freighters, called for gears in such quantities that only mass production methods could supply the demand.

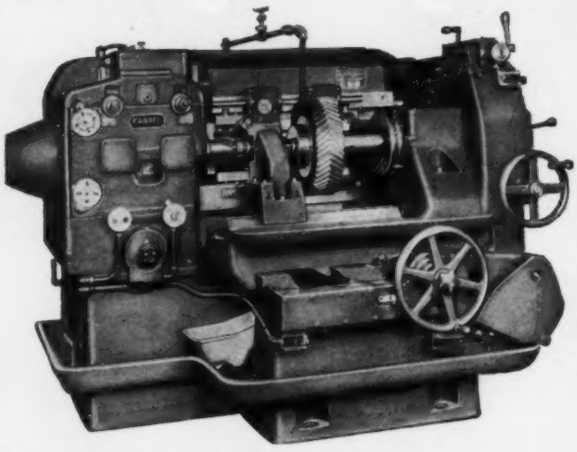
And today these "jewels of power transmission" are flowing out in ever-increasing quantities to speed America's fighting forces—in the air and on the waves—to Victory.

The new manufacturing techniques, and new ways of coupling extreme precision with mass production developed in the plant of Foote Bros. mean more and better aircraft and marine engines. These same lessons applied to the world of tomorrow will mean better machines, more compact and more efficient machines produced at costs that promise greater savings to America's manufacturers.

FOOTE BROS. GEAR AND MACHINE CORPORATION
5301 South Western Boulevard
CHICAGO

FOOTE BROS.

Better Power Transmission Through Better Gears



FARREL-SYKES 2-C GEAR GENERATOR

"No Noise Except The Swish of Oil"

The quiet operation of the Farrel-Sykes 2-C Gear Generator—"No noise except the swish of oil"—tells its own story. In a machine capable of operating as fast as 800 cutting strokes per minute on gears of certain sizes and materials, such quietness demonstrates both advanced design and precision construction.

The machine's precision is, moreover, transferred to its product . . . commercial gears are generated more accurately . . . and high precision gears are cut as readily as ordinary commercial gears.

Farrel-Sykes Gear Generators are built to maintain their precision for many thousands of hours of operation . . . hardened, ground and lapped surfaces are used at points of wear . . . and means of compensating for wear are provided to assure long-lived precision.

Those points are complemented by demonstrated capacity for high output and high earnings, trouble-free performance and sustained operation with low maintenance. Automatic features add directly to output by reducing the attention required from the operator, enabling him to attend two to four machines.

Send for copy of Bulletin No. 442 giving complete description and specifications of the 2-C Gear Generator.

Illustrated above is the size 2-C Gear Generator, which has a capacity from 0 to 25" diameter, 0 to 8" face, 24 DP to 2½ DP. Six other standard sizes are available to cut gears from the smallest practicable minimum to 240" diameter, with face widths up to 60" and pitches from 24 DP to 0.5 DP.

FARREL-BIRMINGHAM COMPANY, INC.
355 Vulcan St., Buffalo, N. Y.

Gear Specialties

SPURS • HELICALS • BEVELS
(Straight & Spiral)
WORM GEARING • THREAD GRINDING
(14 to 96 D. P.)

This range logically embraces the gear components of many critical control devices essential to the war effort and this organization is proud of its contributions of such material in the program.

With full *production capacity* scheduled far into the future, all new inquiries are now necessarily subordinated to these vitally important prior commitments. However, every *urgent* need will be given careful consideration.

Gear Specialties
MANUFACTURERS
CHICAGO

2600 W. Medill Av. **Ph. Hum. 3482**

GEAR CUTTING MACHINES

New Design
New Features
New Advantages

NEWARK GEAR CUTTING MACHINE CO.
69 Prospect Street, NEWARK, NEW JERSEY

FINE GEARS of All Types and Sizes
Spur Gears—½ in. to 30 ft. in diameter
Bevel Gears—½ in. to 13 ft. in diameter
Spiral Gears—½ in. to 16 ft. diameter
Worm gears in any practical size
THE EARLE GEAR & MACHINE CO.
4723 Stenton Ave. Philadelphia, Pa.
85 Liberty St. New York City

EARLE GEARS

GANSCHOW GEARS

FOR SIXTY YEARS
Spur – SPEED REDUCERS – Worm
ALL TYPES OF CUT GEARS
GANSCHOW GEAR CO., 18 N. Morgan St., Chicago

THE JOHNSON FRICTION CLUTCH

Left — Single Clutch with pulley.

Johnson expanding ring type.

. . for maximum serviceability in minimum space

Below — Double Maxitorq. Multi-Disc Type.

The adaptability of JOHNSON FRICTION CLUTCHES to hundreds of different kinds of machines has been possible by the compactness of these sensitive, durable units.

Many leading manufacturers of industrial machinery have standardized on JOHNSON CLUTCHES because their adoption involved minimum changes in design, and assured a maximum in clutch performance.

In addition to compactness JOHNSON CLUTCHES offer quick smooth starting. They are available for high speed on light powered drives and can be depended on for safety, durability and economy.

Let us show you how easy it is to engineer the JOHNSON CLUTCH into your machines. Just send us details of how you propose to apply the clutch. Ask for our assistance today.

Write for Multi-Disc Clutch Catalog No. 114 or Consult "Sweet's or Thomas' Reg."

Has Floating Plates in Neutral

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

EACH GEAR A MASTER GEAR

and the way MEISEL builds gears, there's just one *right* gear for any specific job. Designed for use under conditions that exist, MEISEL Gears actually "belong" to a machine . . . are inherently able to give longer, quieter, more economical service. Investigate the advantages of *specifically* engineered gears by MEISEL.

MEISEL PRESS MFG. CO.

946 Dorchester Ave. Boston, Mass.

GEARED FOR VICTORY

Bevel-Spur-Worm-Helical

THE TAYLOR MACHINE COMPANY

1917 East 61st St. Cleveland, Ohio

"TAYLOR - MADE"

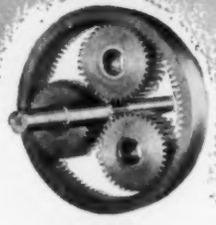
BRAWNY GEARS

PROMPT
ECONOMICAL SERVICE
ALL TYPES, MATERIALS
AND QUANTITIES
Ask for Estimate

BRAUN GEAR CO., 1590-1608 Atlantic Ave., Brooklyn, N. Y.

"General GEAR" IS A FIGHTER TOO...

He's the guy that makes the Jeeps Jump . . . He's also the BIG-WORKS in the tank, battleship or airplane . . . in fact he's the BIG-WORKS in any Power-saving or Power-driving machinery. HE'S GOTTA BE GOOD. Our organization of many years of Gear Making Experience is going to keep him fighting and to help keep all of us on top.



A SET OF PLANETARY GEARS

CONTINUOUS-TOOTH HERRINGBONE GEAR AND PINION

A SET OF SPIRAL BEVEL GEARS WITH PINION BEARING MOUNTING

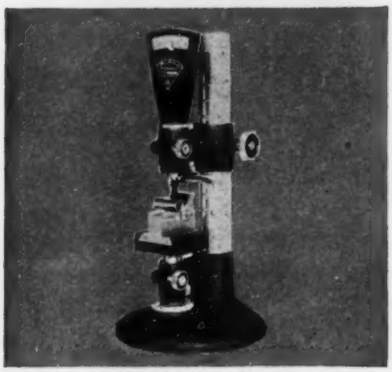
GEAR ASSEMBLY FOR HELICAL WORM GEAR SPEED REDUCER

SET OF WORM GEARS

D.O. James MANUFACTURING COMPANY

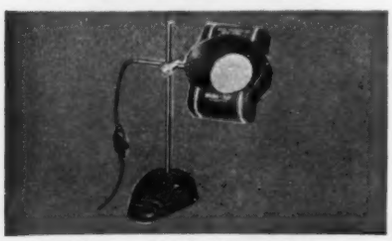
1120 W. MONROE ST. (Established 1888) CHICAGO, ILL.

OTHER INSTRUMENTS IN THE SCHERR LIMITED BUDGET INSPECTION LABORATORY



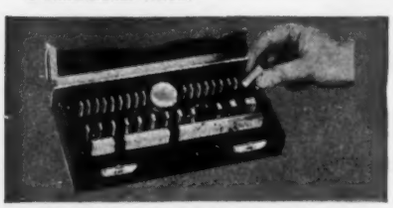
Scherr Comparitol—for checking gage blocks, gages and work for size, accuracy and wear.

Atlantic Adjustable Limit Snap Gages—for accurate check-up, without having to depend on operator's skill. Sizes to 6".

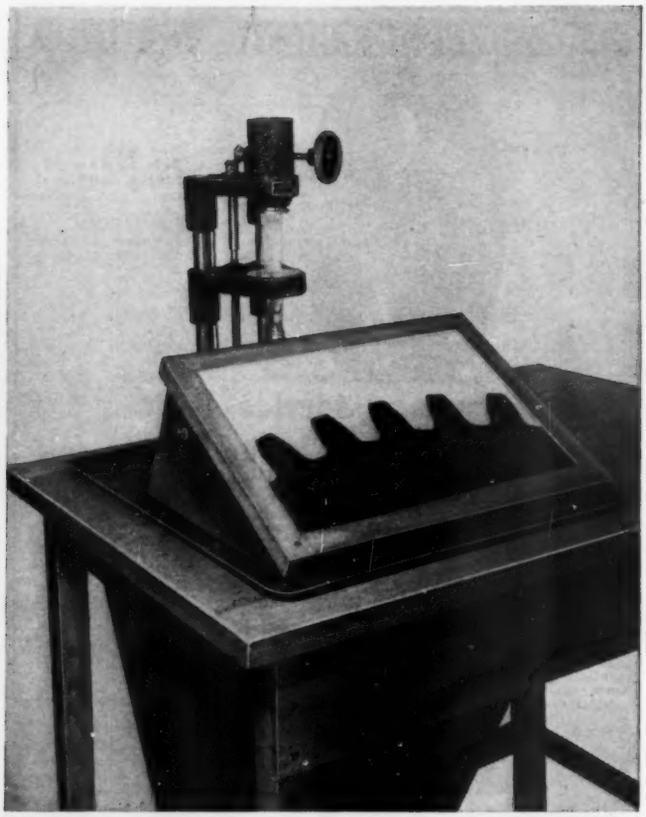


Magni-Ray—a wide field illuminated magnifier for close inspection of work and operations.

Spencer Binoculars—for detecting surface finish, imperfections, etc., by means of 3-dimensional vision.



Ultra-Chex—a 34 block set accurate to .000008" and providing a basic standard of measurements.



Eliminate guesswork

INSURE ACCURATE INSPECTING and CHECKING WITH THE WILDER PROJECTOR

This instrument—at a price within the reach of any shop—is an optical device for measuring or comparing objects by means of a magnified image both in transmitted or reflected light. It provides a simple, accurate method of

. . . checking tools and gages to eliminate errors at their source.

. . . inspecting and measuring tool work, pivoted work and small screw machine parts of all kinds.

. . . verifying tool settings by checking first parts produced.

. . . controlling tool wear through periodic inspection of work.

. . . inspecting finished product.

One of the most useful applications of the Wilder Projector is that of checking threads. By means of this instrument it is possible to detect inaccuracies which cannot be seen with the naked eye nor felt by go and no-go thread plug and ring gages. Low initial cost will be repaid over and over again in savings from the prevention of spoiled work, which results from the use of this instrument.

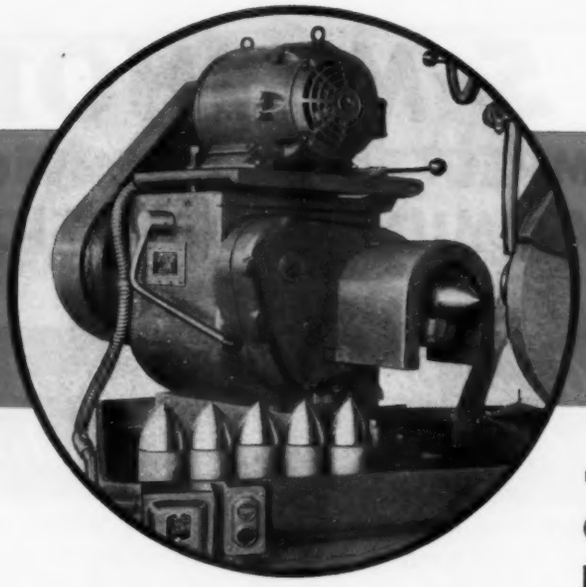
Easy to operate, simple and sturdy in construction, the Wilder Projector offers many opportunities to speed up measuring, checking and inspecting.

CONDENSED SPECIFICATIONS

Standard Magnifications—10x to 100x
Space occupied in bench—21"x24"
Height over bench—18½"
Depth below bench—20"
Size of screen—10½x16"
Size of cross slide stage—6"x5"
Capacity between centers—5"
Maximum swing of centers—2½"

Write, wire or telephone (Canal 6-1464) for further details, quotations and delivery dates.

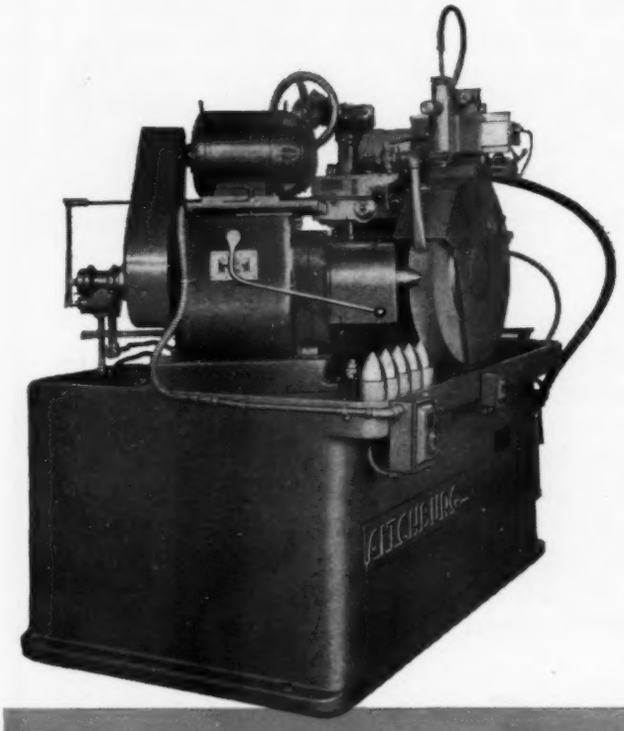
GEORGE SCHERR COMPANY, INC. 124 LAFAYETTE ST., NEW YORK, N.Y.



on Grinding jobs like this

. . . FITCHBURG OFFERS SPECIAL ADVANTAGES IN MASS PRODUCTION

This Fitchburg special Chucking Grinder with a heavy duty headstock, is designed for grinding the ojive of armour piercing shells. The wheelhead is a Fitchburg Standard Bowgage Unit carrying a 24" x 3½" face wheel. A hydraulic form trueing device is mounted on the wheelhead.



To operate this machine the operator places the shell in the open jaw chuck, then, by pushing a ball lever forward, closes the chuck, clamping the work piece at a definite distance from the bottom of the shell. To start the work rotation, operator depresses the long lever and pushes the button to start the automatic grinding cycle.

When installing special precision grinding equipment, it is well to remember that the Fitchburg Bowgage Grinding Wheelhead is a standard unit. It can be remounted on standard machines, or on new special bases, for operations other than the one originally specified. This feature protects your investment.

. . . Write today for folder giving complete details.

FITCHBURG GRINDING MACHINE CORP.

FITCHBURG, MASSACHUSETTS, U. S. A.

Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Bath Full Universal Grinders and Special Purpose Grinders.

5-METHOD
COMPLETE TOOL SERVICE *for* MAXIMUM PRODUCTION

You Grind the Tools You Need from Milled and Brazed Tools

A few typical Milled & Brazed Tools

Milled and brazed tools are meeting with great favor among users of carbide tools. You can select general purpose grades of Ramet Tantalum-tungsten carbide or special purpose grades, depending upon your requirements, and have them brazed to almost any shape of shank. Thus a wide variety of boring, turning, and facing operations on cast iron, steels, and other materials with a minimum tool inventory. A milled and brazed tool is taken from the tool crib and ground to suit particular requirements. Usually a finish ground tool ready to use can be had in less than a half hour. With a little planning, jobs can be tooled with carbide tools in a very short time.

Milled and Brazed Tools is another method of Vascoloy-Ramet Tool Service for tooling for maximum production. Perhaps it is the best method for you. Perhaps it is the best for some of your requirements. This class of tools, especially when ordered in quantities, offer economy and delivery advantages that merit their consideration by both large and small users of carbide tipped tools.

VASCOLOY-RAMET CORPORATION

NORTH CHICAGO, ILLINOIS

DISTRICT SALES AND SERVICE IN PRINCIPAL CITIES

IN CANADA: Carbide Tool & Die Company, Ltd., Hamilton, Ont.

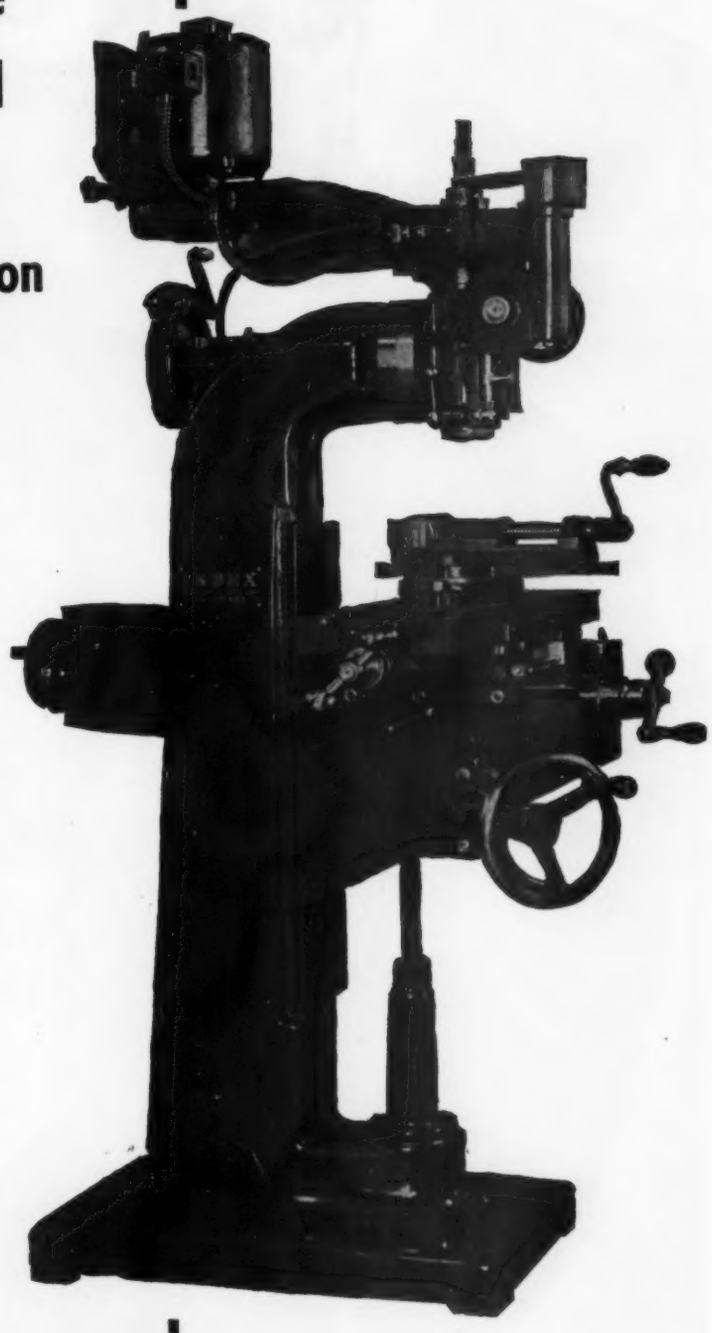
4265

TANTALUM-TUNGSTEN CARBIDE

FOR TOOL SERVICE..... *Specify* Vascoloy RAMET TOOLS

TANTUNG "6"

A Triple Threat Machine for Milling, Drilling and Boring on Tools, Dies, Experimental and Production Work.



Equipped with high grade ball bearing spindle, power feed to spindle and table

VERNIERS FOR LOCATING

Hundreds of these machines are now working 24 hours per day on parts for guns, cameras, binoculars, airplanes, etc.

IF YOU DO NOT KNOW ABOUT THE

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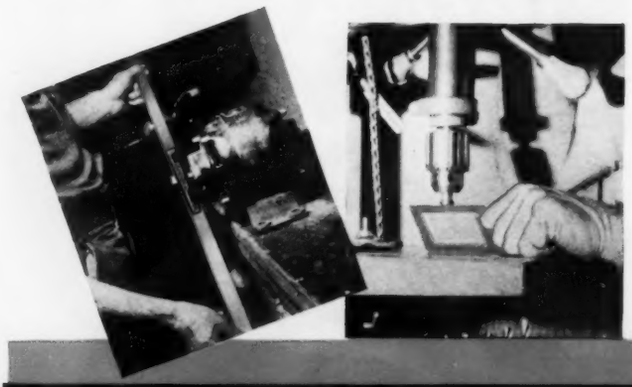
Write to:

BLANK & BUXTON MACHINERY CO.

3100 E. MICHIGAN AVE. • JACKSON, MICH.

A NEW HIGH IN *Finishing Speed*



WELDON ROBERTS

Brightboy

REG. U.S. PAT. OFF.

"The Soft Rubber Binder Cushions The Abrasive"

Finishing speed-ups, frequently combining a number of operations, are being achieved by BRIGHTBOY.

Brightboy bridges the gap between a grind and a buff. Because its abrasive is *rubber cushioned,* it produces a *finish* at substantial savings in operation and labor. Works on all metals—alclad, dural, aluminum, steel, copper, brass.

Brightboy wheels can de-burr, polish and, put on a slight radius in one operation. Brightboy blocks and special shapes have innumerable applications for manual and drill press work, especially for close-tolerance jobs.

Available to war industries through recognized mill supply dealers. Brightboy field men are at your service. Write today for catalogs and prices if your dealer cannot supply you.

BRIGHTBOY INDUSTRIAL DIVISION
Weldon Roberts Rubber Co. Newark, N. J., U. S. A.

1. *Removes light digs, tool and heat marks.*
2. *Cleans welded and soldered joints.*
3. *Finishes dies.*
4. *De-burrs light stampings and machined parts.*

Above, left: Brightboy Wheel smoothing and polishing aluminum part. Edges and holes de-burred in same operation.

Above, center: Part clamped in press being finished by contact with Brightboy Hand Tablet on press table.

PLEDGE SAFETY FOR TODAY AND FOR '43!

SAFETY begins at home with Peerless. Orderly production processes helped Peerless workers double production in 1942 without a lost-time accident. A perfect, national safety record, since Pearl Harbor, would have saved an estimated 500,000,000 man days — sufficient for the building of 300,000 light tanks, or 23,000 huge bombers.

PRODUCTION OF POWER SAWS DOUBLED . . . WITHOUT A LOST TIME ACCIDENT*

One sure way to speed up deliveries to our fighting men is to make all first cuts of the metal the SAFE, ECONOMICAL way. Peerless Power Saws are replacing much of the "chunking-off" equipment—considered good enough in the era when metal was plentiful and manpower still unrestricted. The Peerless cool-running, straight-cutting blade, held firmly in the Four-Sided Saw-Frame, removes as little as 1/16" of the metal. Automatic types are quickly loaded by crane-power. On a single setup of small parts, cutting may progress for several hours without attention. Sawing is a safe operation from the first cut to the finish.

Dozens of America's major suppliers of war materials already are beating schedules by cutting all their metal the high speed, accurate Peerless way.

At this year's end is a good time to renew your production and safety pledges for '43. Literature free for the asking — test samples cut on request.

PEERLESS MACHINE COMPANY • *Racine, Wis.*

Peerless
METAL SAWING MACHINES

PEERLESS MACHINE COMPANY, Dept. AM-1142 Racine, Wisconsin

Mail information on Peerless Saws. We are interested in stepping up production with greater safety.

- ☐ Mail catalog on Hydraulic type Saw for High Production Cutting
- ☐ Mail catalog covering Vertical type used for Die Block Work
- ☐ Mail catalog on Mechanical type Saw for production cutting
- ☐ Mail catalog on general utility and maintenance Saws

Company.....

Individual.....

Street.....

City.....State.....

FAST, ACCURATE CUTTING DEMANDS POSITIVE BLADE CONTROL

TUNGSTEN CARBIDE TIPPED TOOLS

Price $1.00 Each In Any Size

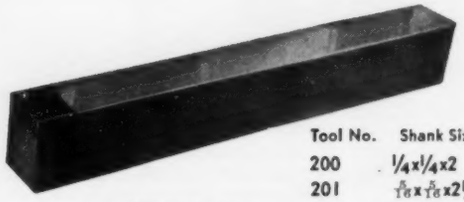
New Low Prices — Increase Production — Cut Operating Costs

Tools are tipped with Tungsten Carbide, and are suitable for machining cast-iron, brass, bronze, aluminum, non-ferrous materials such as hard rubber, bakelite, fibre, and tough alloy steels up to 500 Brinell hardness

Left Hand-Reverse Image. Right Hand Shown

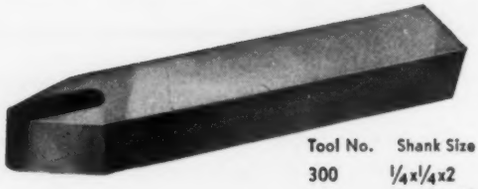
SERIES 100

Tool No. RH	LH	Shank Size
R-100	L-100	1/4x1/4x2
R-101	L-102	5/16x5/16x2 1/4
R-103	L-104	3/8x3/8x2 1/2
R-105	L-106	7/16x7/16x3
R-107	L-108	1/2x1/2x3 1/2



SERIES 200

Tool No.	Shank Size
200	1/4x1/4x2
201	5/16x5/16x2 1/4
202	3/8x3/8x2 1/2
203	7/16x7/16x3
204	1/2x1/2x3 1/2



SERIES 300

Tool No.	Shank Size
300	1/4x1/4x2
301	5/16x5/16x2 1/2
302	3/8x3/8x2 1/2
303	1/2x1/2x3 1/2

Standard Tungsten Carbide Tipped Tool Bits

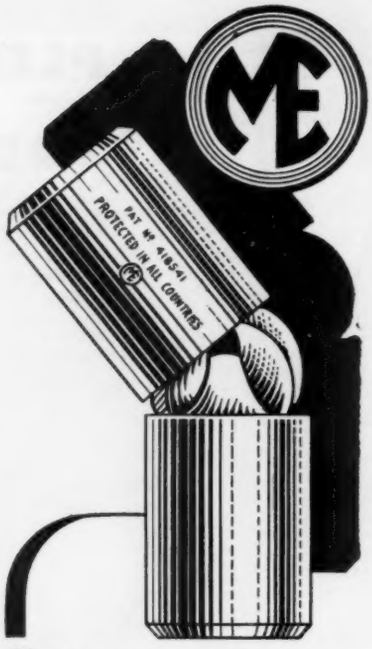
In lots of 12 assorted in any Series; 100-200-300 Series an extra 10% will be allowed; also in lots of 50 assorted 20% discount will be allowed.

Sizes not listed as well as special TIPPED TOOLS will be quoted upon request. When ordering, state tool number and quantity desired.

WE CARRY SILICON CARBIDE EMERY WHEELS FOR GRINDING TUNGSTEN CARBIDE TOOL BITS

Send for our new 1941 general catalogue

VICTOR MACHINERY EXCHANGE, Inc.
251 CENTER STREET NEW YORK, N. Y.



Patent

UNIVERSAL BALL JOINTS

- Made in a range of 9 sizes for shaft diameters 1/4" to 1 1/8".
- Standard Joints have maximum angle of 38° from the straight line.
- Made by the largest manufacturers of UNIVERSAL JOINTS in Great Britain.
- Widely used in Machine Tools, accessory drives and on Aircraft.
- Certified 92% to 98% efficient by the British Government's National Physical Laboratory.

Catalogues on request.

The
MOLLART
Engineering Co., Ltd.

KINGSTON BY-PASS, SURBITON, SURREY, ENGLAND.
Telegrams: PRECISION, SURBITON.

FREE INFORMATION FOR YOUR METAL-WORKING LIBRARY

New Catalogs, Booklets, Bulletins

METAL-WORKING MACHINES

1 LATHES—South Bend Lathe Works, South Bend, Ind. 50-page illustrated catalog describes in detail with specifications toolroom lathes, quick-change gear lathes, plain-change gear lathes, turret lathes and attachments.

2 MILLING MACHINES — Kent-Owens Machine Co., Toledo, O. 36-page illustrated, plastic-bound catalog describes line of milling machines. Diagrams give details of construction with specifications.

3 PLANERS & MILLERS — Cincinnati Planer Co., Cincinnati, O. 32-page illustrated bulletin 152, gives details of Cincinnati Hypro, double housing planers, open-side planers, planer-type millers, and vertical boring mills. Specifications given.

4 GRINDERS—H. Leach Machinery Co., Providence, R. I. Folder describes external grinder for use on small parts up to 7" in diameter and 11" in length. Illustrated with specifications.

5 METAL PARTS WASHERS—Detroit Rex Products Co., Detroit, Mich. 24-page illustrated catalog describes Detrex products for production cleaning, including metal-cleaning machines, chemicals and processing equipment. Comprehensive diagrams and illustrations throughout.

6 LATHES—Rivett Lathe & Grinder Inc., Boston, Mass. 12-page illustrated Bulletin 500, gives specifications and details on tool-room lathes, plain bench lathes, hand screw machines and internal grinders. Also on milling attachments, thread tools and collets.

7 SURFACE GRINDERS—Abrasive Machine Tool Co., East Providence, R. I. 8-page illustrated folder, details with specifications and features, surface grinding machines, both horizontal and vertical spindle types. Also attachments for abrasive grinders.

8 GRINDING MACHINES — Fitchburg Grinding Machine Corp., Fitchburg, Mass. 8-page illustrated folder on adjustable angular head grinding machine. Has diagrams and illustrations of machine and construction.

9 LATHES—Nebel Machine Tool Co., Cincinnati, O. 84-page illustrated catalog on cone- and geared-head engine, removable block gap and extension bed gap lathes. Illustrates plant and various departments used in manufacture. Gives complete details of parts of machines, specifications and illustrations.

10 DRILLING AND MILLING MACHINES—Baush Machine Tool Co., Springfield, Mass. 10-page illustrated catalog describes with specifications hydraulic multiple spindle drilling machines, and hydraulic horizontal boring and milling machines. Also back spotfacing machines and special combination machines for high production.

TOOLS AND ACCESSORIES

11 PRECISION CUTTING TOOLS—C & W Tool Co., Cambridge, Mass. 4-page illustrated folder describes line of high speed precision cutting tools of all types. Illustrates and details careful manufacturing processes and special design incorporated in each. Of interest to all users.

12 DRILL HEADS—Michigan Industrial Sales Co., Detroit, Mich. 4-page illustrated folder has detailed description of Sensaumatic drill head with metered feed. Lists special features and advantages of use in various set-ups.

13 INSPECTION INSTRUMENTS — Trico Products Corp., Buffalo, N. Y. 8-page folder describes Micro-Chek, a precision inspection instrument with built-in limit indicators to copy range of tolerances from master parts. Gives features and advantages of use, and describes multiplying dimensions by as much as 200.

14 BROACHES — Detroit Broach Co., Detroit, Mich. Wall card gives timely hints on proper care in resharpening broaches to prolong life. Handy for users.

For Your Convenience

Two business-reply cards are printed here. On each is room for you to request four pieces of literature.

How to Order

1. If you are requesting four pieces or less, please use only the bottom card. Likewise, for five to eight pieces, use both cards.

2. Be sure to fill one space for each piece you order. This will assure your receiving copies of literature promptly by reducing clerical work in handling your requests.

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AMERICAN MACHINIST, New York. 11-26

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Company.....

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..... Title.....

AMERICAN MACHINIST, New York. 11-26

Write in circle number of item describing one catalog wanted → ( )

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Company.....

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..... Title.....

AMERICAN MACHINIST, New York. 11-26

15 CUTTING TOOLS — Genesee Tool Co., Fenton, Mich. 32-page illustrated catalog gives dimensions and details on line of screw arbors, carbide tools, cutters, end mills, reamers, etc. A very complete line.

16 PACKAGING MATERIALS—Michigan United Laboratories, Muskegon, Mich. Folder describes paper developed to replace Burlap that meets government specifications. Strong, flexible, waterproof and air resistant. Samples attached. Of interest to all with packaging problems for shipping.

17 SOLDERLESS TERMINALS — Aircraft-Marine Products, Inc., Elizabeth, N. J. 4-page illustrated folder describes precision crimping tool for use in placing terminals on wires. Describes advantages through elimination of solder and easy operation by unskilled users. Claim precision performance of hand-operated die.

18 RADIUS DRESSERS — Schultz & Anderson Co., Newark, N. J. 4-page folder describes C-66 radius dresser for surface grinders. Gives outstanding features with operations illustrated showing how difficult jobs are made easy.

19 INDICATOR HOLDERS — Oslund Tool & Die Co., Hartford, Conn. Folder describes time-saving holder for all types of indicators on jig borers, boring mills and milling machines. Has installation photos and shows how set-up time is saved and efficiency raised.

20 MICRO-PLATE — Industrial Chromium Corp., Holyoke, Mass. Two folders describe chromium plating process for reclaiming parts that do not meet specifications or for building up worn parts. Valuable, time-saving, process.

21 WASHER DIES — Hovis Screwlock Co., Detroit, Mich. 4-page folder describes universal washer dies showing how use of three standard types of dies give innumerable combinations for producing different sized washers. Details this outstanding time and money-saving method.

22 DIAMOND TOOLS—Precision Diamond Tool Co., Chicago, Ill. 4-page folder describes diamond wheel emery dressers, multiple diamond wheel dressers, thread-dressing tools, radius forming tools and radius type thread grinding tools.

23 TRUEING AND DRESSING TOOLS —Norton Co., Worcester, Mass. 20-page booklet shows how to use trueing and dressing tools for better grinding. Of particular interest to all plants using these tools in present emergency.

24 GRINDING WHEELS — Mid-West Abrasive Co., Detroit, Mich. 26-page illustrated data booklet "Grinding Wheels—Their Construction and Selection" shows how grinding wheels and abrasives are made. Tables and charts on grain and grain specifications, recommended grinding wheel speeds and other valuable data.

25 FRICTION TAPPERS — Lafayette Tool & Supply Co., New York, N. Y. 4-page folder on new friction tapper that will save intricate set-up operations as well as costly jigs and fixtures, and which does not require skilled operators. Can be used in drill chuck of any ordinary drill press. Includes specifications and price.

26 GRINDING FIXTURES—Industrial Engineering Co. Inc., Chicago, Ill. 4-page folder on grinding fixture for power hacksaw blades. Describes construction and use, and shows how blades can be reground five to ten times and produce as many cutting hours as a new blade.

27 DIAMOND TOOLS — E. Karelsen, Inc., New York, N. Y. 4-page illustrated folder describes diamond emery wheel dressers and careful selection of stones. Also multi-set dressers, needle-point diamonds, thread grinding tools and shaped diamond tools. Includes data on correct dressing procedure and chart of recommended diamond weights for various-sized wheels.

28 PRODUCTION LABELS — Ever Ready Label Corp., New York, N. Y. Catalog describes money- and time-saving job use of proper labels in plants do. 48-page catalog gives suggestions as to use in assembly, machining and shipping departments. Samples include production labels used by Sperry, Republic, Curtis-Wright, Western Electric and many others. Special labels available that will stay put on metal to replace and save metal tags. Useful data.

29 TOOL SHANKS — Cooper-Bessemer Corp., Mt. Vernon, O. Bulletin shows stock sizes and prices of Victory Tool Shanks—cast of tough, durable Meehanite. Useful to those who tip own tools.

WELDING

30 WELDERS — Progressive Welder Co., Detroit, Mich. 4-page Bulletin 301 on Temp-A-Trol Forge Welder, Bulletin 70 on Standard Rocker Arm Welders, Bulletin 501 on Standard Pedestal Welder, and Bulletin 801 on Seam Welder.

31 GALV-WELD — Galv-Weld, Inc., Dayton, O. 6-page folder describes Galv-Weld process and shows how you can weld ganvanized sheets and shapes and leave entire structure rust-proofed by regalvanizing weld. Interesting description with illustrations.

PARTS AND MATERIALS

32 SPECIAL STEELS—Allegheny Ludlum Steel Corp., Pittsburgh, Pa. 130-page wire-bound handbook of special steels, their properties and uses, gives detailed and valuable engineering data on tool steels, special products, nitralloy steels, stainless steels, electrical steels, carbon steels, and has tables and reference material.

33 SCREW MACHINE PRODUCTS—Manufacturers Screw Products, Chicago, Ill. 96-page illustrated catalog and price list. Gives specifications, illustrations and details of aviation products, machine screws, cap screws, set screws, sheet metal screws, Phillips Head Screws, etc.

34 ALUMINUM ALLOYS — Reynolds Metals Co., Richmond, Va. 30-page illustrated booklet "Aluminum Alloys for Aircraft." Gives a great deal of valuable data on working of alloys. Handy reference.

35 SPRING WASHERS—National Lock Washer Co., Milwaukee, Wis. 12-page catalog on non-ferrous Kantlink Spring Washers in Everdue, K-Monel, and stainless steel. Gives recommendations and details for use.

36 STAINLESS STEEL—Rustless Iron and Steel Corp., Baltimore, Md. 22-page booklet "Shop Notes on the Machining of Stainless Steel" gives valuable data with clear diagrams.

37 FASTENERS — Prestole Devices, Toledo, O. Folder describes Prestite the safe skin holder with diagrams and illustrations, and features advantages of use in assembling aircraft skins, and shows tools used.

38 ELECTRIC MOTORS—General Electric Co., Schenectady, N. Y. 40-page illustrated "Motor Fitness Manual" shows how to get the most service out of old and new motors, switching motors from one job to another, and equipping old machines with new motors. Also selection and application of motors, various types of motor inclosures, and other valuable data in use and care.

39 HIGH SPEED STEELS — Crucible Steel Co. of America, New York, N. Y. 4 bulletins describe with detailed specifications Rex MM Molybdenum High Speed Steels, Rex MMM Molybdenum High Speed Steels, Drill Rods and Rexalloy Tipped Tools. Handy booklet.

40 STEEL TUBE COUPLINGS—L & L Manufacturing Co., Van Dyke, Mich. 20-page booklet describes L & L steel tube couplings, designed to give users a dependable steel fitting with ample strength and simplicity of installation at reasonable cost. Diagrams of pipes and sizes with prices.

FIRST CLASS
PERMIT No. 10
(Sec. 510, P.L.&R.)
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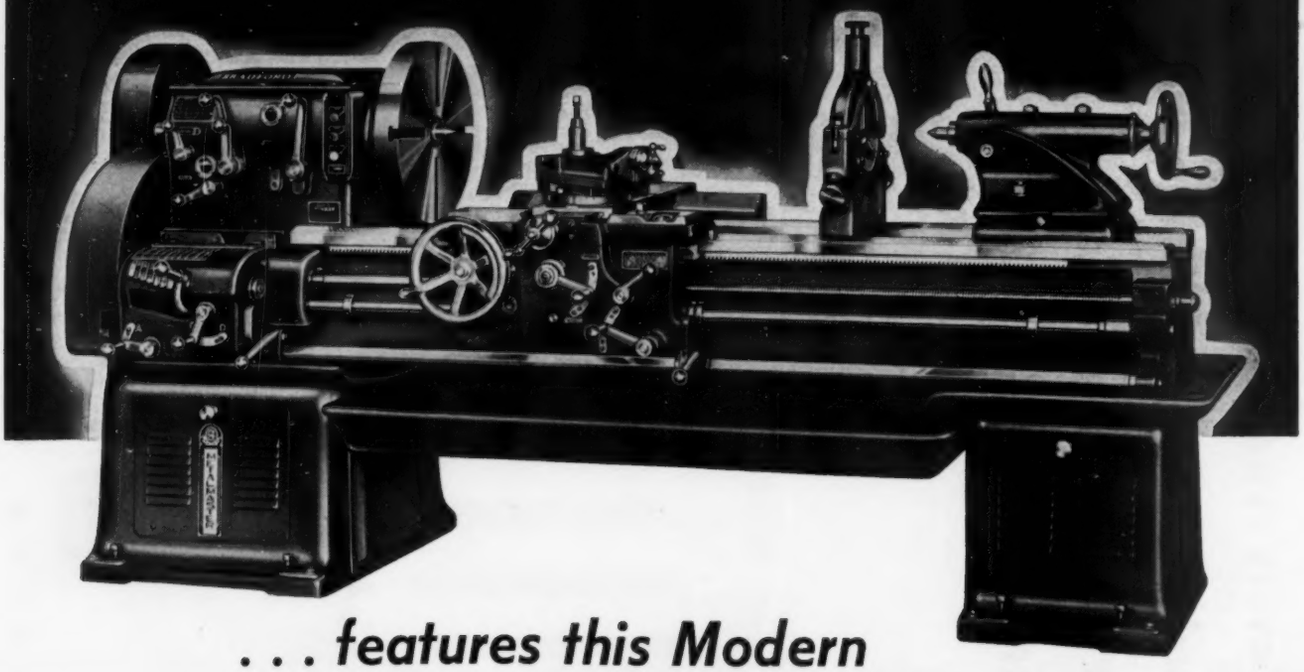
Applied to virtually every type of tool-holding operation, the Jacobs Chuck delivers the convenience, the accuracy, the speed for Victory production. Experience proves that "if it's a Jacobs . . . it holds!"

JACOBS

THE NATIONAL STANDARD *for* **WAR PRODUCTION**

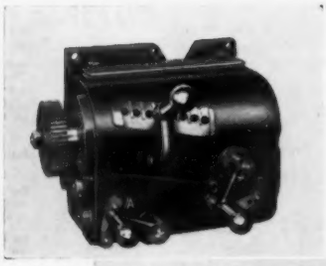
The Jacobs Manufacturing Co., Hartford, Conn.

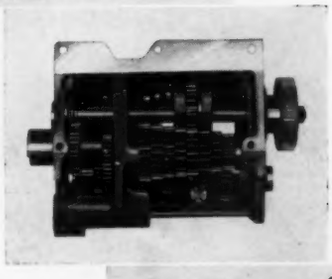
The Metalmaster



. . . features this Modern

QUICK CHANGE FEED BOX





● One of BRADFORD'S most valuable contributions to the modern lathe was the pioneering of the Quick Change Feed Box. Today, the METALMASTER features an advanced design that offers 64 changes ranging from fine to coarse. A direct reading index plate shows the positions for the conveniently located shifter handles for all threads and feeds, including 11½ threads. All sliding gears have pointed teeth and are mounted on ground splined shafts, with integral cut keys, to facilitate easy engagement. A semi-steel idler gear, mounted on roller bearings, connects the feed box to the head gearing. This gear is easily replaced by special compounding, or translating gears, for cutting odd threads not included in the regular range, or for metric pitch screws.

METALMASTER LATHES . . . in 12", 14" and 16" capacities.

Write for the new METALMASTER CATALOG—it gives complete details.

The BRADFORD MACHINE TOOL Co

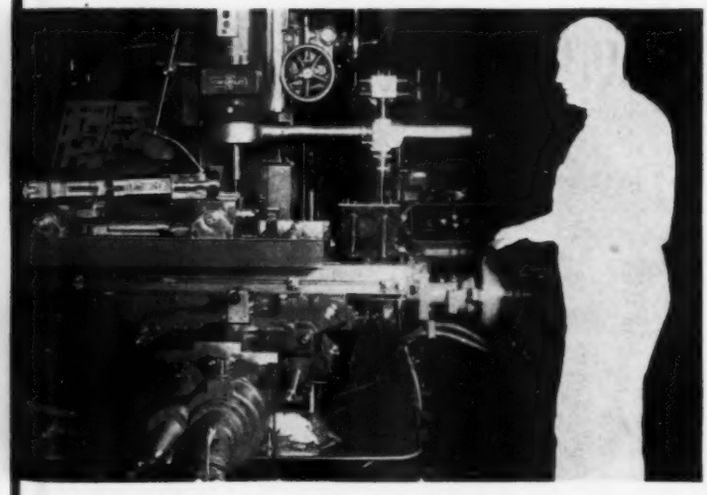
MANUFACTURERS OF METAL WORKING LATHES; CAM FEED DRILLING AND TAPPING EQUIPMENT, HYDRAULIC DRILLING MACHINES . . . IN BUSINESS SINCE 1840

659 EVANS AVE. . . . CINCINNATI, OHIO

"LET ME DO THAT *Contour Machining*"

If I can lift that work I can machine it!"

With a DUPLIMATIC on the job, the accuracies you've got to have at the speeds you demanded are now a fact. You shove a DUPLIMATIC up to any machine tool, connect it up and within a few hours the old operator, or a "greenhorn," is doing more work, more accurately even, than was ever possible by manual control alone.



This mill is equipped with a DUPLIMATIC. During the actual cutting, the operation is *full automatic.* She CAN operate this milling machine just as she can quickly learn to handle any standard tool room machine if it has a DUPLIMATIC.

Can she lift the work? That's the only question before she "takes over" from the recently drafted, skilled operator you thought you couldn't get along without.

DUPLIMATIC automatically turns one, two or three feed screws, on almost any standard machine tool in your plant. Turns them simultaneously, yet independently of each other. The result is blended radii . . . less hand-finishing . . . fewer scrapped parts.

Faster, More Accurate Contour Machining

Prompt deliveries of DUPLIMATICS eliminate long waiting for specially built automatic machines. Added floor space is not required.

Ask for complete information. Find out how the biggest mass producers of war goods like Pullman-Standard, Pressed Steel Car, Pontiac, Chevrolet, Buick, Cadillac and all the other important producers are using DUPLIMATICS to produce more TANKS TORPEDOES • BOMBS • GUN PARTS • AIRPLANE ENGINE PARTS • TANK TURRETS ANTI-AIRCRAFT GUN PARTS • AIRPLANE LANDING WHEELS . . .

When your pet machinist gets drafted . . . draft *DUPLIMATIC.*

Send for complete details NOW!

DUPLIMATIC

and your present tool room tools will do more contour machining faster, more accurately and with less skilled help.

DETROIT UNIVERSAL DUPLICATOR CO.

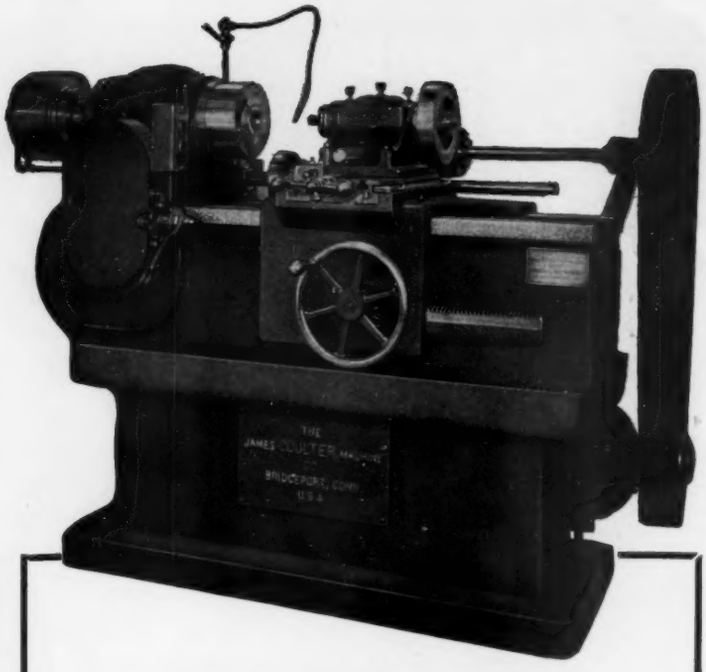
737 E. Milwaukee Ave. Detroit, Michigan

Keep Ahead of
DEFENSE DEMANDS
on the PRODUCTION of
EXTERNAL and INTERNAL THREADS

The Coulter Type "H" Hob Thread Miller—modern in every detail of design and construction—handles high speed, accurate production of right or left hand threads. Any parts that can be held in ordinary chucks, air operated chucks, air operated collet chuck or special face plate fixture can be threaded on this machine.

Work holding spindle and cutter spindle are driven by individual motors through worm and gears. Speed changes to work spindle are accomplished by pick-off gears; cutter spindle speeds are controlled by variable motor sheave. All high speed shafts turn in anti-friction bearings.

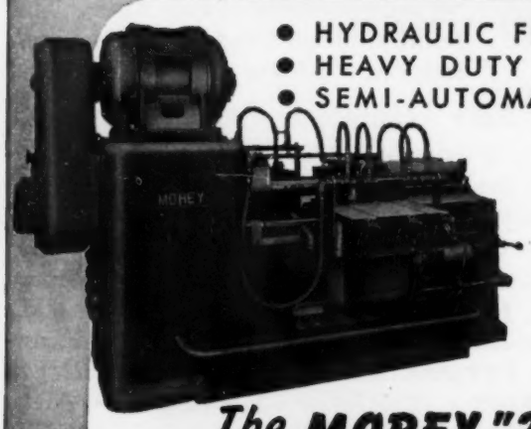
Maximum external thread, 7"; minimum hole depends on smallest hob practical.



Send for Descriptive Bulletin giving full information.

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

Suitable for 105 M.M. to 155 M.M. Shells



- HYDRAULIC FEED
- HEAVY DUTY
- SEMI-AUTOMATIC

The MOREY "27" SHELL LATHE

Timken Tapered Roller Bearings for Main Spindle—All Others Anti-Friction

The HYDRAULIC FEED insures an almost effortless operation. Rigid enough to use carbide tools to their full capacity—entirely self-contained—no outside or auxiliary equipment required! Details in Circular 715—ask for it.

MOREY MACHINERY CO., INC
410 BROOME STREET • NEW YORK, N. Y.

Now! *A Complete Manual on*
MARKING DEVICES
For Every Industrial Use

Request A Copy On Your Letterhead!

Plant Managers! Superintendents! Purchasing Agents! Production and Plant Engineers! Here's a book that will give you the answers to your marking problems. It contains hundreds of illustrations, with concise descriptions of Marking Devices for every Industrial Marking application. Yours for the asking . . . request a copy on your letterhead today!

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FAST-CUTTING, LONG LASTING

DISSTON
HACK SAW BLADES

are immediately available!

Disston offers these superior hack saw blades to help you speed production, save time, do more accurate cutting and get longer cutting life per blade.

Disston Hack Saw Blades meet today's demands for super-production with better work at lower cost, because they are accurately made, correctly heat treated and hardened by Disston specialists.

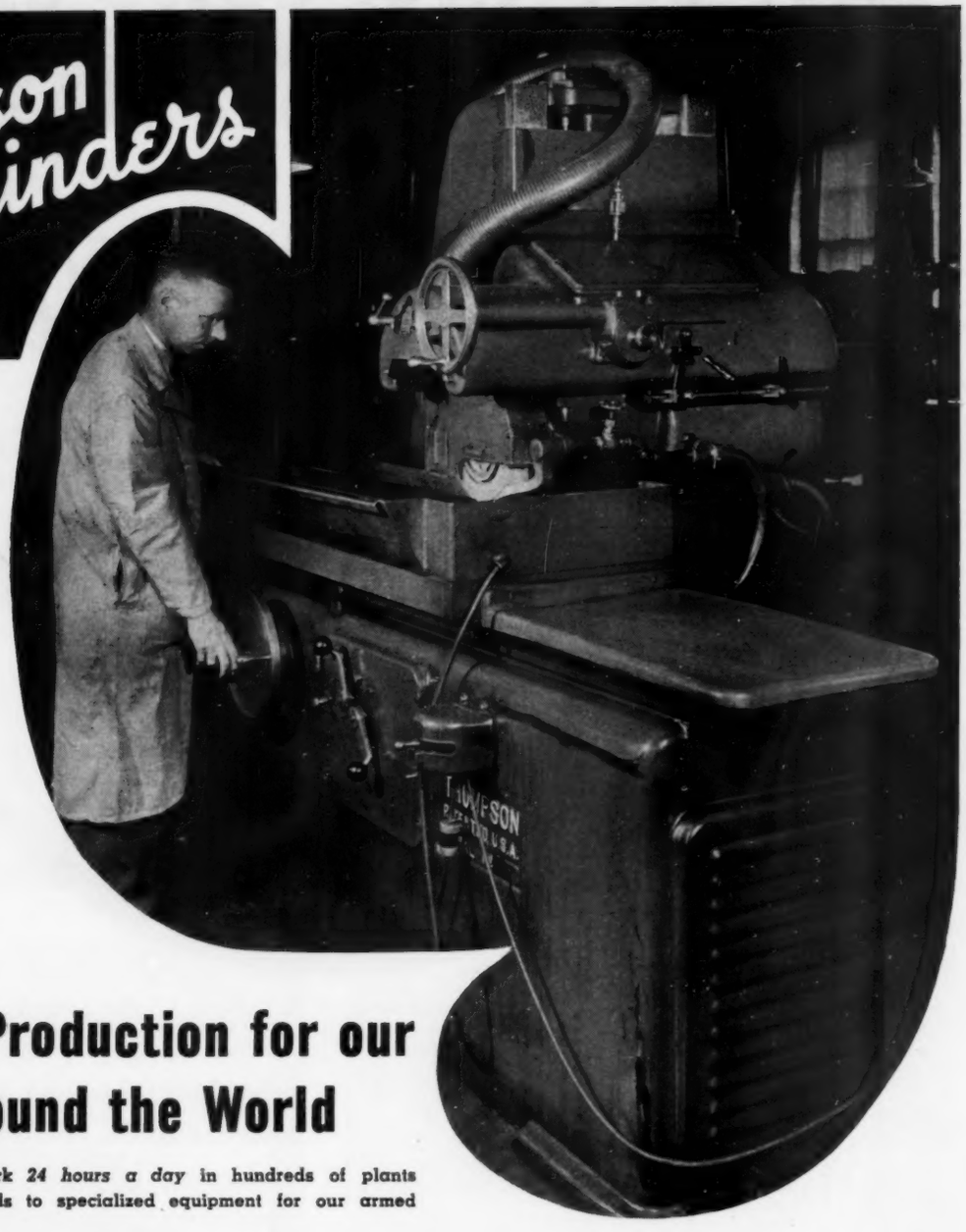
In general machine or hand cutting, tough Disston Di-Mol Hack Saw Blades have proved in tests to last 7 times as long as ordinary blades. For cutting stainless steel and other extra-hard alloy steels Disston High Speed Steel Blades are recommended.

See your distributor about Disston Hack Saw Blades, *available now!* And for engineering advice and help on any metal-cutting problem, write our technical staff. Henry Disston & Sons, Inc., 1120 Tacony, Philadelphia, Pa., U. S. A.

Send for the Booklet describing the DISSTON CONSERVATION CONTROL PLAN and containing reproductions of Instruction Cards covering the proper use and care of 34 different types of cutting tools. The cards are free on request.

GET YOUR SCRAP INTO THE SCRAP!

Thompson grinders



Smooth out Production for our Forces Round the World

Thompson Grinders are at work *24 hours a day* in hundreds of plants producing everything from shells to specialized equipment for our armed forces.

Here's a Type C Thompson Grinder grinding Clips of S.A.E.—2330 steel to close tolerances for a machinery manufacturer in the east. These 7" long pieces require 3 grinding operations, one on each of 3 sides, at the rate of 1.4 minutes per piece.

Thus Thompson Grinders are turning out work of exceptionally smooth finish —to close tolerances—quickly for manufacturers engaged in all types of production for our War effort.

If you want a smooth job—if you want to smooth out your production schedules—if you want dependable, accurate grinding—Consult Thompson.

THOMPSON BUILDS

surface grinding machines for all types of flat surface grinding from the small tool room grinder 6" x 18" to large C type 30" x 196".

THE Thompson GRINDER CO.

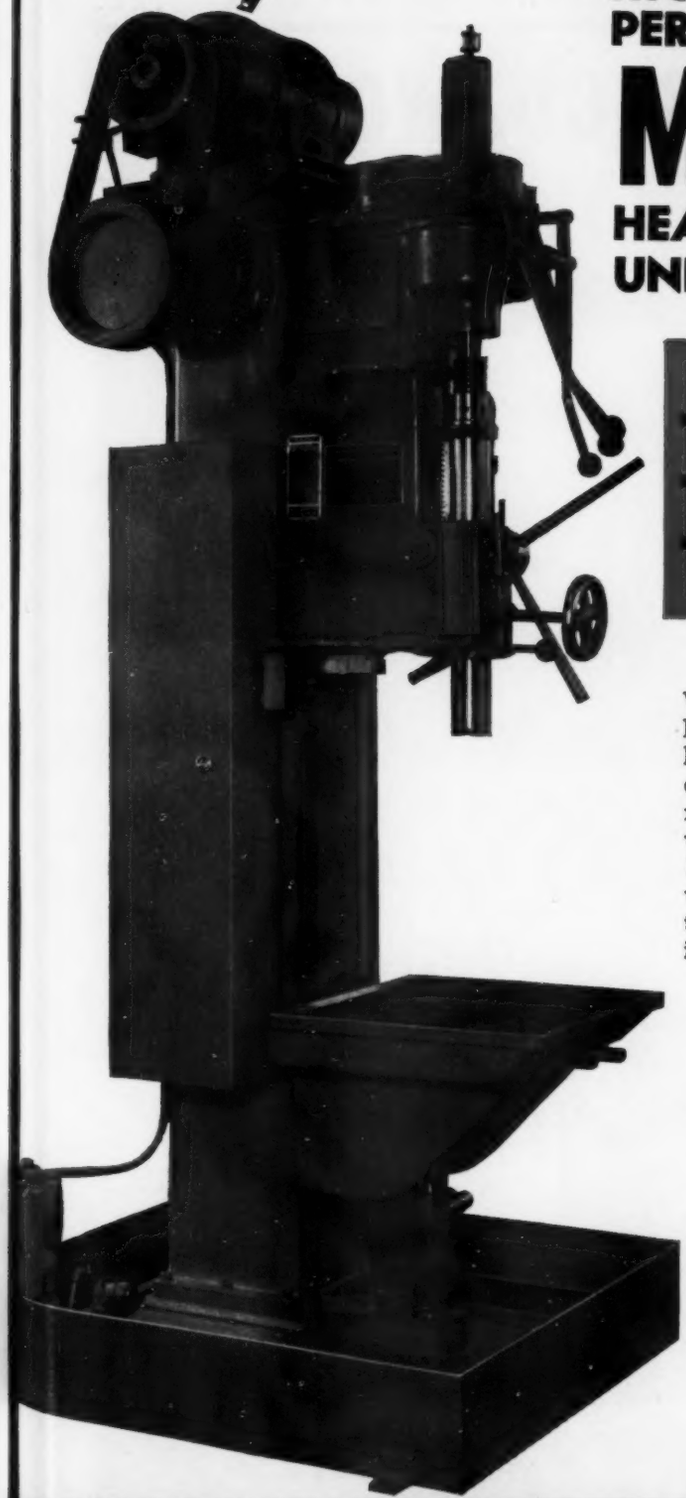
SPRINGFIELD, OHIO

BAKER

. . . OFFERS YOU HIGH CAPACITY DRILLING PERFORMANCE with the NEW

MODEL No. 150

HEAVY DUTY DRILLING MACHINE UNIVERSAL QUICK CHANGE TYPE



. . . SPEEDY
. . . VERSATILE
. . . EFFICIENT

● A new BAKER-built unit—the Model No. 150 Heavy Duty Drilling Machine—has been specifically designed to supplant the proved and satisfactory Model No. 121. It has wider speed and feed ranges, so as to meet today's expanded demands with a greater degree of economy and efficiency.

With conditions such as they are . . . more and better production being the order of the day . . . let's consider the Model No. 150's highly effective speed range. Twelve instantaneous quick changes, from 48 to 1120 R.P.M., are available. In addition, each machine is furnished standard with one set of pick off gears, which doubles range of available speeds to twenty four up to 1120 R.P.M. Needless to say, such speedy versatility, combined with the other characteristics found in this machine, stamp it as the unit you need to meet expanded production schedules. Get in touch with us—write, wire or phone—we'll be glad to give you complete information—send you descriptive folders—engineering data sheets.

The MODEL NO. 150

CAPACITY . . ample to drive 1½" diameter High Speed Twist Drills, to the limit of their efficiency in steel. Can be adapted to boring, counterboring, facing, forming and tapping operations.

DESIGN and CONSTRUCTION . . . incorporates vertical column assembly of 2-piece design. Spindle is of forged high carbon steel—has No. 4 Morse Taper. Spindle end has cross slot for holding tool securely.

DRIVE . . . furnished motor driven only. Power transmitted through multi-vee belts. Machine is standard furnished with reversing Controller allowing for Tapping. Manual Control with Push Buttons. Machine also furnished Single Purpose type.

BAKER BROTHERS INC. Toledo, Ohio, U.S.A.

OUR MOTTO SINCE 1867
"MACHINES: STURDY and EFFICIENT,
AS FINE AS CAN BE BUILT . . ."

DRILLING • BORING • TAPPING
AND
KEYSEATING MACHINES

Greenlee AUTOMATIC NEWS

PREPARED BY GREENLEE BROS. & CO., ROCKFORD, ILL.

GREENLEE BROS. & CO. WORKERS SALUTED BY ARMY AND NAVY

Honored With The Army-Navy Production Award

In an impressive ceremony on the company grounds, Greenlee Bros. & Co., Rockford, Illinois, was presented with the prized Army-Navy "E" Production Award, Thursday, September 3.

This proud citation to the Greenlee Organization and its workers is in recognition of outstanding services in the production of machinery and tools vital to the war effort.

The award, consisting of an "E" flag to be flown above the plant and a lapel pin for every Greenlee employee, was presented by Lieut. Colonel Edward H. Bowman, chief of Chicago Procurement District, and Lieut. Commander R. J. Twyman, District Personnel Office, 9th Naval District.

Lieut. Colonel Bowman is shown above presenting the Army-Navy "E" Flag to Mr. George C. Purdy, president of the company. In making the pennant award, Lieut. Col. Bowman declared, "The Army Air Force congratulates the management, and you, the workers, for your excellency in workmanship on the critical machines you are manufacturing. . . ."

EMPLOYEES GIVEN PINS

All employees of the plant — most of whom work 12 hours or more each day turning out the machine tools needed to produce the weapons of war — received silver pins, symbolic of the Government's appreciation of the fine work they are doing. The photograph at the left shows Lieut. Commander Twyman presenting lapel pins to representatives of the employees. Lieut. Commander Twyman saluted the Greenlee Men and Women for their exceptional performance in turning out Greenlee Automatic Screw Machines, Greenlee Special Transfer Machines for machining airplane engine parts, Greenlee Woodworking Machinery and Greenlee Tools.

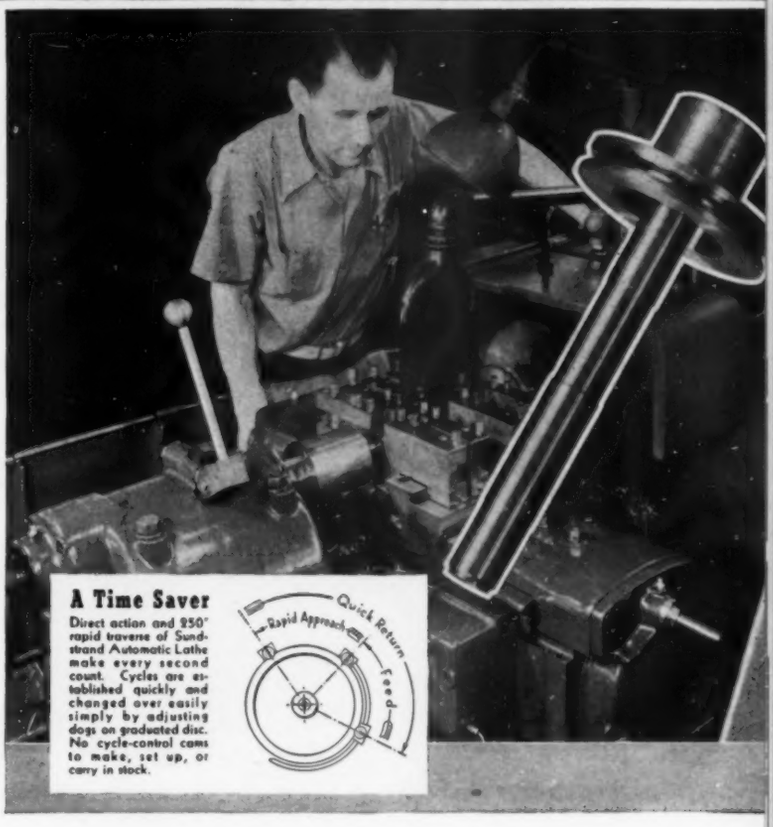
MULTIPLE-SPINDLE DRILLING, BORING AND TAPPING MACHINES

Greenlee BROS. & CO. ROCKFORD ILLINOIS U.S.A.

AUTOMATIC SCREW MACHINES
AIRCRAFT PRODUCTION MACHINERY

Engineered Production

Turning Time Cut From 13 to 3 Minutes On Aircraft Engine Parts


A Time Saver
Direct action and 250" rapid traverse of Sundstrand Automatic Lathe make every second count. Cycles are established quickly and changed over easily simply by adjusting dogs on graduated disc. No cycle-control cams to make, set up, or carry in stock.
Quick Return
Rapid Approach
feed

Turning tailshafts for aircraft engines, engineered production on Sundstrand Automatic Lathe shown at right reduced turning time from 13 minutes to 3 minutes for one operation; and makes similar time savings in two additional turning operations on these parts.

High Production — Exclusive Sundstrand advantages promote high production, with closely controlled accuracy; on turning these tailshafts in several sizes each requiring different set-ups.

Quick Set-Up — The operating cycles of Sundstrand Automatic Lathes are established quickly and easily by simple adjustment. Correct speeds and feeds are secured readily through pick-off gears. Sundstrand standard tool blocks and bases also facilitate rapid set-up and change-over from one job to another.

Fast, Easy Operation — It is easy to get operators for Sundstrand Automatic Lathes. No previous experience or special training is necessary. Operators merely change work-pieces and start automatic cycles, the machines do the hard work. An operator can usually run two or more Sundstrand Automatic Lathes easily.

Other Work — Parts for a great many other urgently needed products, besides aircraft engines, are being turned most effectively on Sundstrand Automatic Lathes. Operation data sheets supplied promptly on request.

Engineered Production — Sundstrand Engineered Production Service is at your disposal for quick action in solving turning production problems. Use this service freely, especially on urgent war jobs. Be sure to send complete accurate information, with each inquiry.

For You ➡

This booklet describes Sundstrand adjustable cycle control, shown in panel above, and many other Automatic Lathe advantages. A copy will be mailed to you promptly on request. Write for it, today. Ask for Bulletin 106.

★ ★

The Army-Navy "E" flag flies above the Sundstrand plant. Every member of our organization is proud of his part in earning this award. We are firmly resolved to scale new heights of production achievement, to maintain steadily our high standards of accuracy, and to cooperate closely with every effort directed towards victory for the United Nations.

SUNDSTRAND MACHINE TOOL CO.

2533 ELEVENTH STREET, ROCKFORD, ILLINOIS, U. S. A.

"Blount" MODEL F. WET TOOL GRINDER

New!.....for tool room or shop—assures stepped up production

The MODEL "F" is a distinctly new wet tool grinder with advanced features which adapt it to modern production in grinding all hard metal, special alloys and tungsten carbide. It is built for long, hard service and can be depended on to speed up grinding operations. It is built in 14", 20" and 30" sizes.

Outstanding features include:

. . . motor mounted in air-flow base for cool running. It is easily accessible for take-up of multi-v belt.

. . . quick and easy wheel change made possible by merely removing cover on wheel side unscrewing a single nut and removing flange.

. . . oversize spindle shaft turns on Timken tapered roller bearings mounted in specially designed pillow block, easily adjusted.

. . . constant flow oiling of positively sealed spindle bearings.

. . . wheel and shaft adjustable for balance.

. . . all belts are completely adjustable.

. . . wheel dressing simplified by means of a new combination tool rest and wheel dresser permanently located in front of wheel.

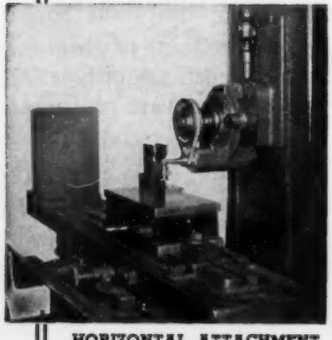
. . . convenient remote control provided for coolant.

Send for CIRCULAR A-7 which contains complete details and specifications.

J. G. BLOUNT CO., Everett MASS., U. S. A.

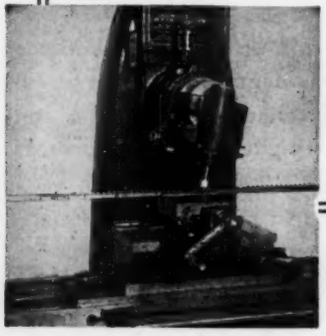
SIMPLIFY *and* SPEED UP SET-UPS

with LIBERTY HI-SPEED GRINDING ATTACHMENTS



HORIZONTAL ATTACHMENT
Grinding Gaging Seat on Special Gage

VERTICAL ATTACHMENT
Grinding Clearance of Broach Teeth



Designed for the most accurate tool, die and gage work

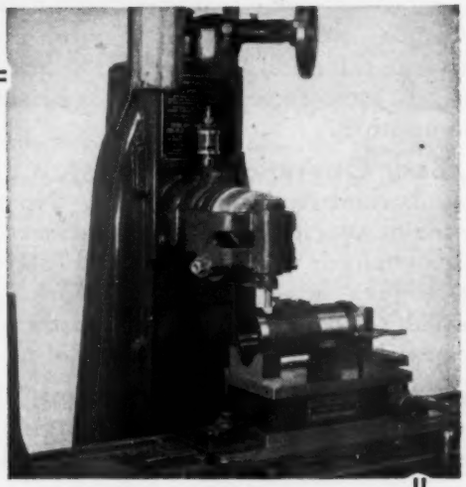
These new attachments provide the means for quick, simplified set-ups—in tool room, die shop and grinding room.

Applicable to the grinding of gages, angles, slots, recesses and difficult-to-get-at surfaces, Liberty Hi-Speed Grinding Attachments speed work and insure accuracy. Places impossible to reach with large wheels are readily accessible; long expensive set ups, requiring small wheels, are eliminated.

An almost unlimited variety of applications are possible with assurance of extreme accuracy wherever used. Attachment can be made quickly and shifted to numerous positions.

Liberty Hi-Speed Grinding Attachments are available for vertical and horizontal spindles and fit Browne & Sharpe, Reid and other makes of surface grinders.

These units are assembled complete with any size bores, pulley belts and grinding wheels at no extra cost.



VERTICAL ATTACHMENT
Grinding Rectangular Opening in Trigger Casing

FOR COMPLETE INFORMATION WRITE TODAY—

specifying diameter of spindle head, type and make of grinder. Also for Illustrated Descriptive Bulletin.

LIBERTY TOOL & GAGE WORKS

PROVIDENCE • RHODE ISLAND

BUILT OVERSIZE FOR STRENGTH AND RIGIDITY

Here's Defiance dependability on the job at another large War Plant. This Defiance mill is built oversize for strength and rigidity to meet tank production requirements.

More and more today... master mechanics and shop men throughout wartime industry are finding Defiance performance the *right* answer to tough production problems. Defiance engineering know-how assures outstanding simplicity and practical features in Defiance mills!

In Model 25 shown here, there are fifteen outstanding features... including (1) only horizontal boring mill having outboard bearings an integral part of machine... no worry as to accuracy of supports; (2) very wide support—full 58" across outboard bearings eliminates dangerous overhang on long work; (3) width of base 58"—keeping out torsional strains. See our insert in Sweet's Mechanical Catalog or write for latest bulletins.

Defiance Machine Works, Inc., Defiance, Ohio.

Makers of Precision Machinery Since 1850

Horizontal **BORING..MILLING..DRILLING..TAPPING** *Machines*

DEFIANCE

NORTON ABRASIVES

SIMPLE, SENSIBLE SAVING

Photo of a Good American Saving Steel and Time

By merely touching up the edges of his lathe tools with an INDIA Oilstone, this experienced machine operator is *saving steel* — yes, and *saving time* as well.

Equipping *every* user of a metal cutting tool with an INDIA — there are several sizes from 50¢ to $1.50 — can pay big dividends in your shop from all these angles:

Prolonging intervals between grinds — less frequent tooling up

Saving costly material lost in grinding

Removing any small scratches or burr on freshly ground edges

Providing more efficient cutting — it's the edge that counts

Reducing work in the grinding room

But be sure you specify

INDIA

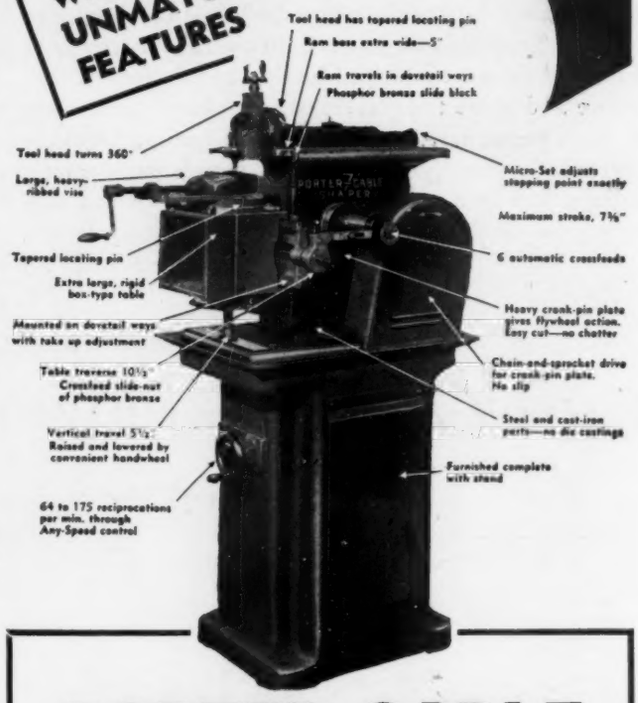
Certified Distributors in all Major Trading Areas.

BEHR-MANNING
(DIVISION OF NORTON COMPANY)
TROY, N. Y.

Dependable Abrasives Since 1872

Alone in it's Field!

With All These UNMATCHED FEATURES


Tool head has tapered locating pin
Ram base extra wide—5"
Ram travels in dovetail ways
Phosphor bronze slide block
Tool head turns 360°
Large, heavy-ribbed vise
Micro-Set adjusts stopping point exactly
Maximum stroke, 7¼"
Tapered locating pin
6 automatic crossfeeds
Extra large, rigid box-type table
Heavy crank-pin plate gives flywheel action. Easy cut—no chatter
Mounted on dovetail ways with take up adjustment
Chain-and-sprocket drive for crank-pin plate. No slip
Table traverse 10½" Crossfeed slide-nut of phosphor bronze
Steel and cast-iron parts—no die castings
Vertical travel 5½" Raised and lowered by convenient handwheel
Furnished complete with stand
64 to 175 reciprocations per min. through Any-Speed control

PORTER-CABLE
7" SHAPER
Available Now . .

The new Porter-Cable Chain Drive 7" Shaper is the fastest-cutting, strongest, most versatile shaper of its size ever developed—that's why it fits the needs of production and toolroom jobs alike. Look at all the outstanding features outlined above! In addition, this tough little shaper is notable for speed of set-up, ease of operation and fine precision. And it's got the weight and rigidity, the wear-saving chain-and-sprocket drive to handle unusual power and extra-heavy cuts.

You can't find a smoother-running, more chatter-free shaper anywhere! And you can't match its low operating and upkeep cost. Find out all about it from your local Porter-Cable man—(name in telephone directory) or simply write us for all particulars.

SEE OUR DEMONSTRATION
SPACES 7 and 701
THE POWER SHOW
Nov. 30 to Dec. 5
MADISON SQ. GARDEN
NEW YORK CITY

PORTER-CABLE MACHINE CO.
1725-11 N. Salina St.,
SYRACUSE, N. Y.

Broader Applications-

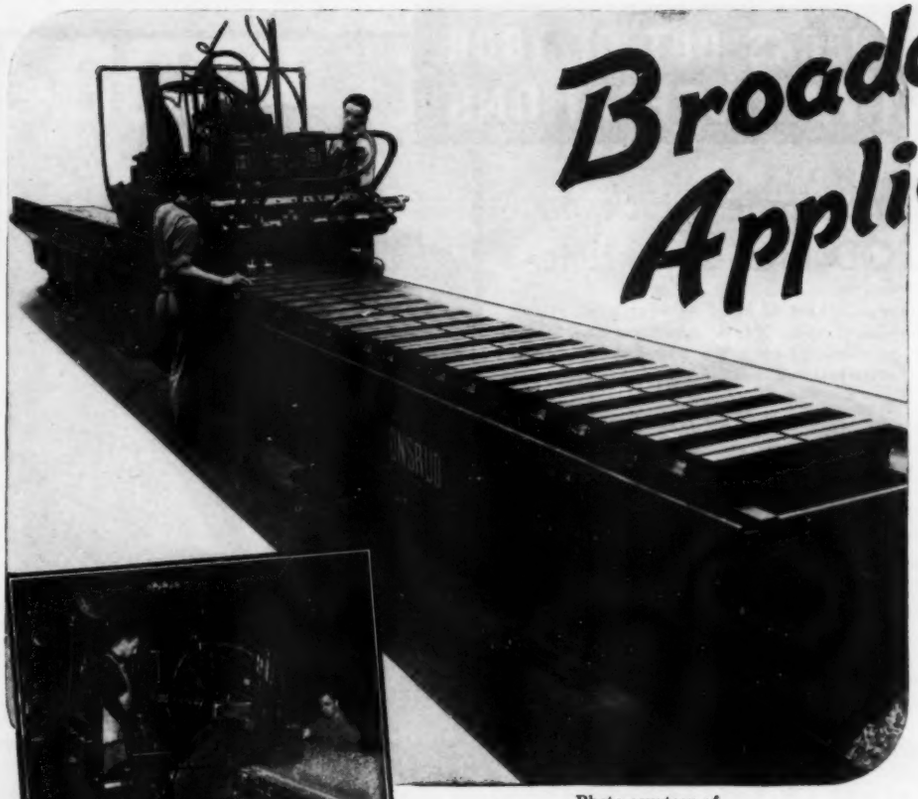


Photo courtesy of
Curtiss-Wright Corporation
(Missouri Plants)

FASTER FULL RANGE MILLING

- Feed variable from 2" to 19' per minute.
- As many as three operations may be completed at one time.
- Open front bed allows easy loading . . . takes wide over-hanging work.
- High cycle motors furnished at any desired HP, turn cutters under direct drive . . . horizontal at 5,400 RPM, vertical at 10,-800 RPM.

Double carriage Spar Miller. First carriage makes rough cuts . . . second the finishing cuts. Photo courtesy of Curtiss-Wright Corporation New York plants.

Spar Miller vertical cutter in position to make "hogging" cut. 1½" cutter at 10,800 RPM, mills off ¼" aluminum alloy flange. Photo courtesy of Curtiss-Wright Corporation Missouri plants.

Tilted vertical motor and cutter milling variable angle or twist cut on base of a spar beam. An infinite number of planes may be machined on work, one blending or twisting into another. Photo courtesy of Curtiss-Wright Corporation New York plants.

WITH ONSRUD SPAR MILLERS

High speed Onsrud Spar Millers are setting unprecedented production records throughout the nation in milling extrusions, billets, and plate to size and shape. With one horizontal cutter and two pivot arm mounted vertical cutters, the machine performs as many as three operations at one time. Scallop and straight line work are automatically milled with former bars guiding the cutters during the carriage feed.

Onsrud Spar Millers are built today to meet the production requirements of each individual plant. The design of tools and fixtures in relation to the work is a part of the Onsrud service. For example, one of the new Spar Millers has a bed 45' long to permit milling the entire length of a 38' spar beam in one set-up. Among the many unusual operations possible with the Onsrud Spar Miller is that of variable angle or twist cutting . . . performed with a vertical motor and cutter assembly that tilts 10° forward or backward in a cross-the-bed vertical plane.

Complete data is now available to production executives concerning all types of Onsrud Spar Millers, and applications. Your inquiry is invited.

ONSRUD MACHINE WORKS, INC.
3921 Palmer Street **Chicago, Illinois**
Sales Offices in all Principal Cities

Onsrud
AIR TURBINE and HIGH CYCLE TOOLS and MACHINES
ROUTING · DRILLING · SHAPING · GRINDING · MILLING

TAKE THE BOTTLENECKS OUT OF YOUR COLD METAL SAWING OPERATIONS

Cut your 3 inch and larger stock on the PORTER-McLEOD *and save time*

This new machine provides an economical means of handling your cutting off operations on a high production basis. More cuts, greater accuracy and lower operating and maintenance costs are outstanding advantages offered you by the 8" Porter-McLeod Cold Metal Sawing Machine.

This machine is recommended for general work and for production work in single or multiple units. Its capacity permits of "nesting" bars and shapes using the Porter-McLeod systems of "multiple or interchangeable nests" which provide support for each nest on both sides and bottom. By this method of nesting of bars and shapes, multiple units can be cut at one time and work speeded up.

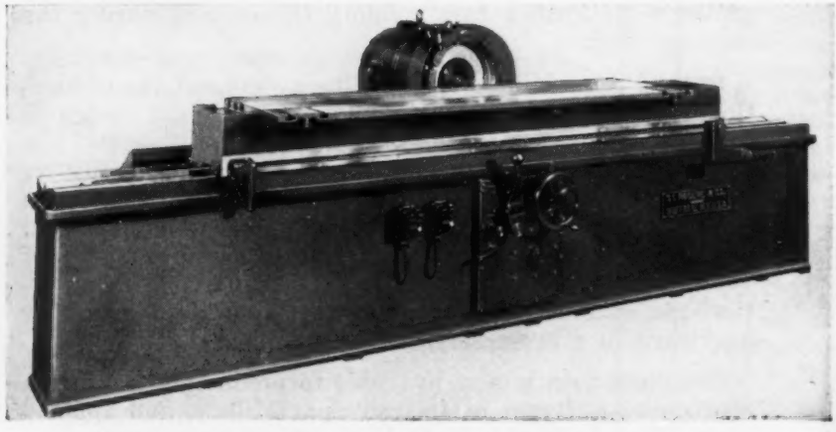
Ability to cut stock from 3 inches and up at high speed and with straight cuts is made possible by the Porter-McLeod method of pulling the blade upward through the stock and by supporting the blade, front and back on diameters well out from the center where support is needed.

These and other outstanding valuable features are fully described in engineering bulletin available on request. Send for your copy TODAY!

PORTER-McLEOD MACHINE TOOL CO., INC.
HATFIELD, MASS., U. S. A.

MACHINE TOOL COMPANY

To Satisfy Repeated Inquiries . . . We *Announce the*
NT-20 ROGERS FACE GRINDER



TYPE NT-20 CAPACITY 60"-72" x 16" x 12"

Built and guaranteed by a company with 56 years experience in the grinding machinery field. Send for Circular NT-20.

Specially Designed for
High Production of Long, Narrow and Light Work

Of heavy, rugged construction, this new model traveling table face grinder is built to take work 10" to 12" high. Table length is 72"; table width is 16". A 10 H.P. motor mounts a 20" cylinder grinding wheel for medium duty service. Two-speed table traverse powered by 3 H.P. Motor.

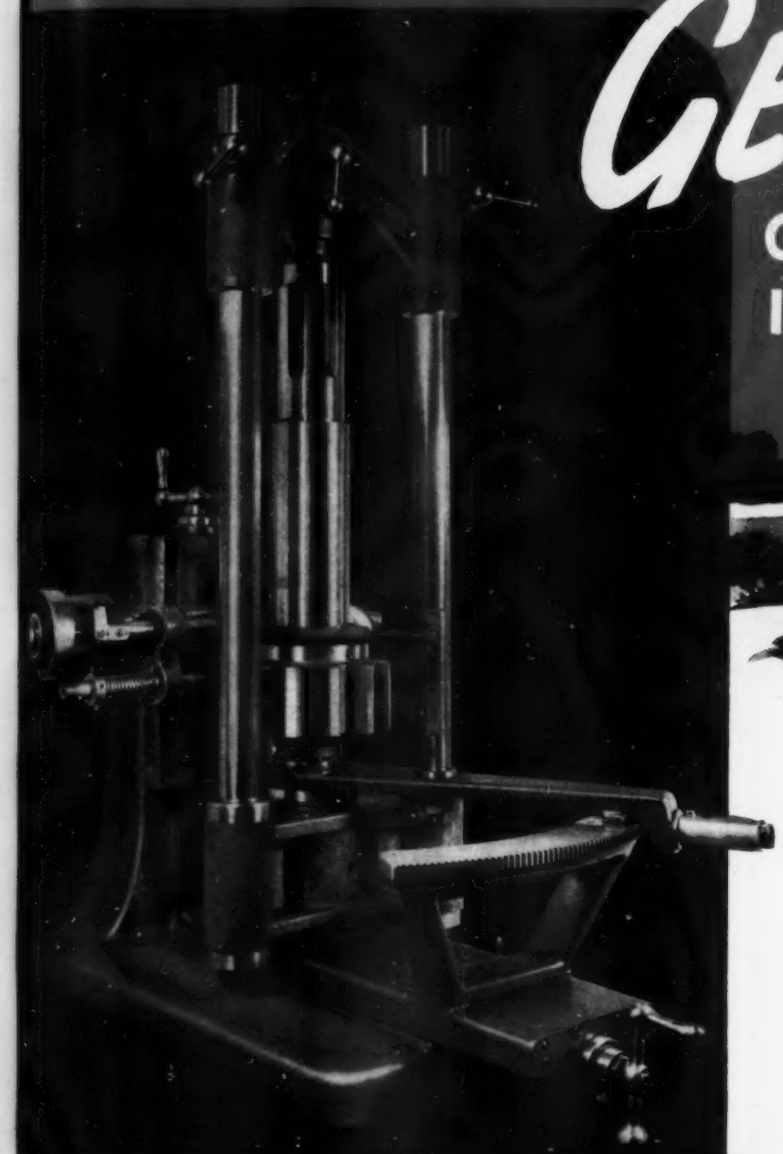
★

SAMUEL C. ROGERS & COMPANY, 197 Dutton Ave., Buffalo, N. Y.

PRECISION QUALITY **ROGERS KNIFE GRINDERS** SINCE 1887

Check Gear Tooth Curves with GEARGRIND

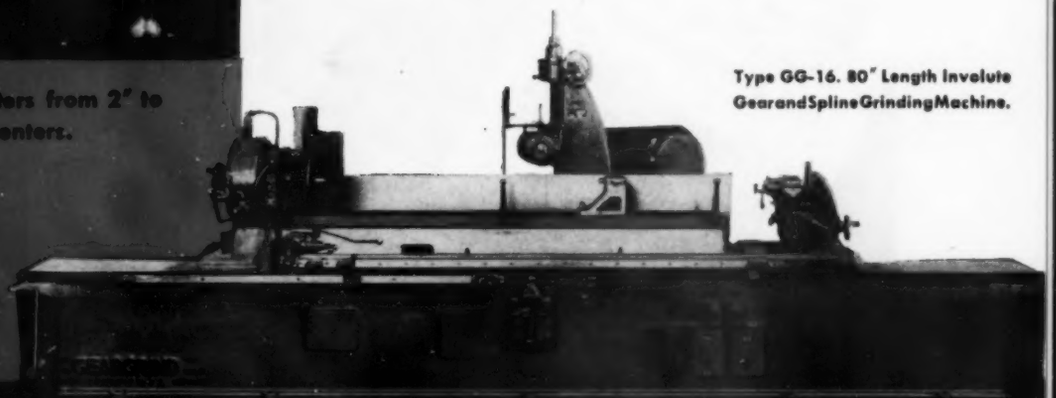
GEAR TOOTH INDICATORS



GEARGRIND Gear Tooth Curve Indicators have been designed to indicate and plot tooth curves *accurately*. They are manufactured to handle gear diameters of from 2" to 18". They will indicate and plot the tooth forms of spur, bevel and helical gears, rotary cutters and hobs. Gears and gear cutters are indicated direct. Rotary cutters and hobs are checked from soft gear blanks cut by them. Indicators and their operation are described fully in our catalog. Write for your copy.

Type M1-6. For gears with diameters from 2" to 9", on arbors up to 24" between centers.

GEARGRIND Machines are available for the formed wheel grinding of internal and external gears, internal and external involute splines, straight splines, serrations and racks.



Type GG-16. 80" Length Involute Gear and Spline Grinding Machine.

The GEAR GRINDING MACHINE COMPANY
DETROIT, MICH. U.S.A.

Get this Good Boring Mill

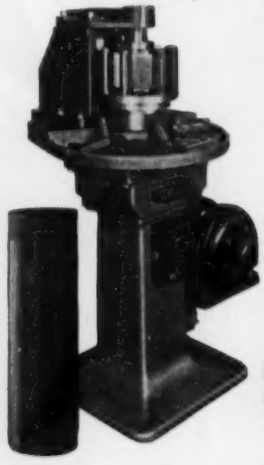
Buying a Boring Mill? Why not get one with ALL of the newest and best features?

* The new Yoder 3A Horizontal Boring Mill bulletin is yours for the writing.

The YODER ENGINEERING MANUFACTURING SALES COMPANY
Cleveland, Ohio

Buy War Bonds

Knurls and Marks
IN ONE OPERATION



The simultaneous performance of two or more operations such as combining knurling and marking is only one way in which Noblewest marking equipment speeds production, cuts costs. Noblewest equipment is saving time and money every day in marking hundreds of different products with precision and speed that only long experience and careful engineering could produce. Model 73 (illustrated) is tooled for marking and knurling vulcanized fibre handles. Write today for full information.

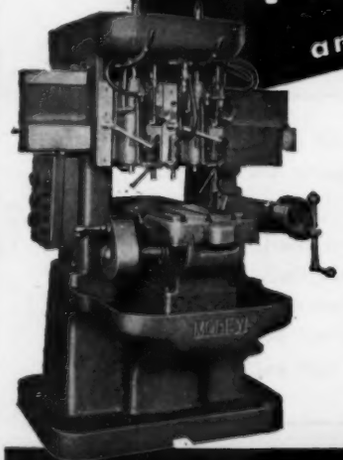
NOBLE & WESTBROOK MANUFACTURING CO.
Marking Specialists Since 1904
EAST HARTFORD, CONNECTICUT

MARK IT BEST WITH NOBLEWEST

NOBLEWEST IMPROVED MARKING

Preloaded Precision Bearings for Spindles

MOREY 12M
HIGH-SPEED VERTICAL PROFILER and MILLER

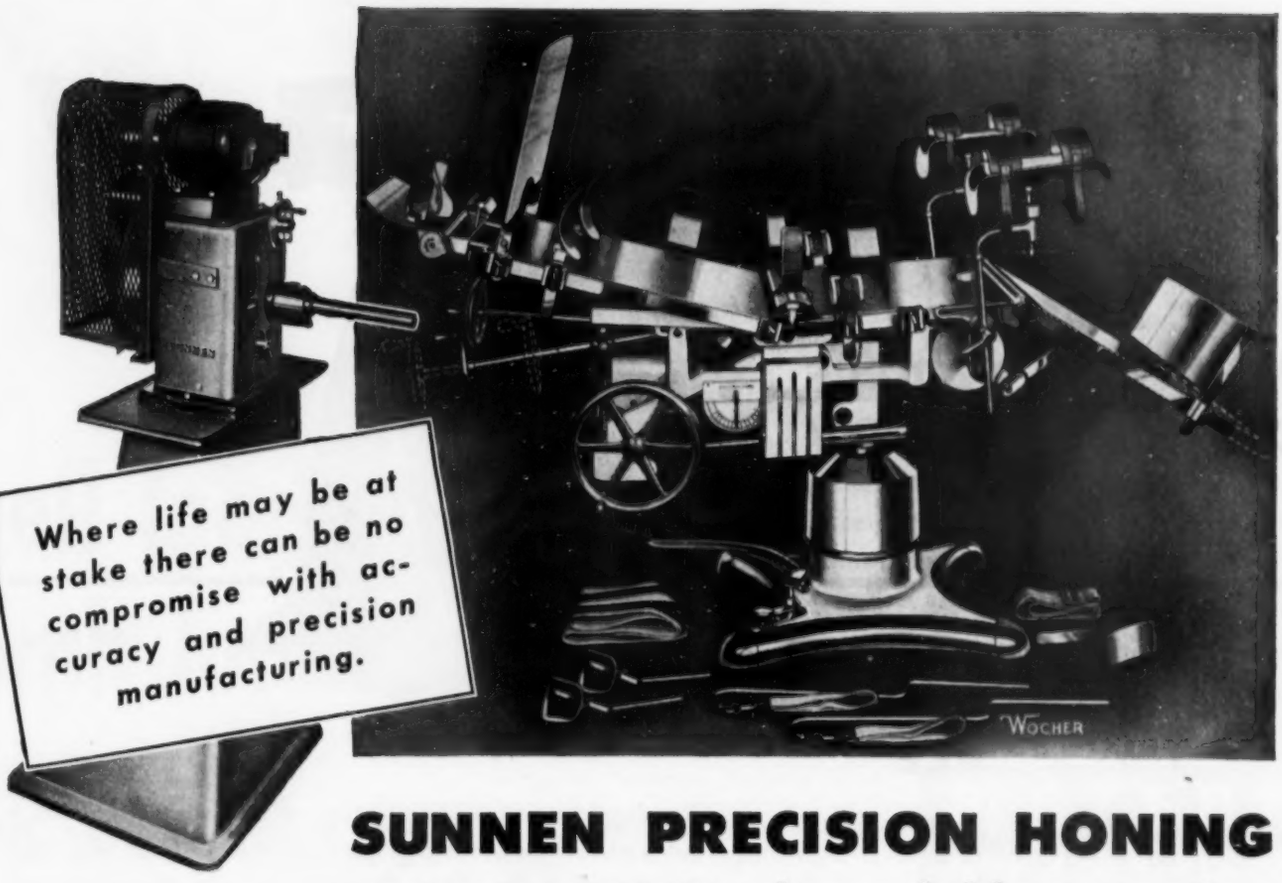


Two spindle or single spindle

Speed and more speed in the production of interchangeable parts requiring milling of any contour or outline is yours in the MOREY 12M. Provision for increased clearance between spindles and table.

Ask for Bulletin 680-A

MOREY MACHINERY CO., INC.
410 Broome Street New York, N. Y.



SUNNEN PRECISION HONING

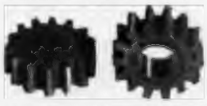
assures accurate, dependable operation of Wocher Major Operating Table

"Strict alignment maintained between two holes."

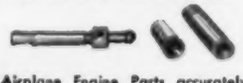
Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch."

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Inner Bearing Ring "Accurately removes last 'tenth' of stock."



Hardened Steel Gears. Honing used to remove any distortion after hardening and to selectively size the gears to uniform diameters.



Airplane Engine Parts accurately honed to a super-smooth finish.

The hydraulic cylinder and valves of this famous operating table used by the Army and Navy are *precision honed* by the Sunnen method to obtain accurate, dependable performance.

This is just one more example of the hundreds of ways in which the Sunnen "MA" Precision Hone is serving industry in our all-out war effort.

Put Sunnen Honing to Work in Your Plant

The "MA" is *fast!* Its *accuracy* conserves vital war materials, assures absolute interchangeability of parts. Low in cost, economical to operate.

Wide Range — handles any internal diameter from .185" to 2.400".

Easy To Operate — workers in 'teens — even girls — can be trained to handle jobs in "tenth's" in a few hours.

No Fixtures Needed — work held in hands. Relieves big internal grinders for other jobs.

Let a Sunnen Engineer Check Your Jobs!

We'll gladly have a Field Engineer check your grinding or honing jobs in your plant with our "MA." Or write for free bulletin giving complete information.

Sunnen Awarded Army-Navy "E"
for its production of honing equipment being used throughout industry in the manufacture of vital war materials.

SUNNEN

SUNNEN PRODUCTS COMPANY, 7941 Manchester Avenue, St. Louis, Missouri
Canadian Factory: Chatham, Ontario

An

"ACE"

FOR THE BATTLE OF PRODUCTION

Oliver **"ACE"**
Universal Tool and Cutter Grinder

Keeping tools in condition to turn out maximum production is a big part of the battle on America's industrial front. An "ace" for this job is the Oliver Universal Tool and Cutter Grinder. Versatile, fast and accurate, it is capable of producing mathematically correct cutting teeth and edges on a wide range of milling cutters, end mills, saws, reamers, hobs and special tools. The Oliver principle of tool grinding is the reason for the increased speed and wide range of the ACE; the tool is held stationary and the grinding wheel traverses the work. This method permits the use of the simplest of fixtures, only two of which are necessary to grind the majority of tools. The wheel has a stroke of 10" through a rack and gear and a 15" bearing, all fully protected from dust and grit. Tool efficiency will help to win the battle of production! Keep your tools accurate and fast cutting . . lengthen their useful life by sharpening them on Oliver Tool Conditioners.

Don't Neglect Your Toolroom It's the Backbone of Production!

OLIVER INSTRUMENT CO.
1414 EAST MAUMEE STREET
ADRIAN MICHIGAN

Oliver
OF ADRIAN

AUTOMATIC DRILL GRINDERS — TOOL AND CUTTER GRINDERS — DRILL POINT THINNERS — TEMPLATE TOOL GRINDERS — FACE MILL GRINDERS — DIEMAKING MACHINES

Shell loading
Bomb loading

Two war jobs for W-S presses

PUTTING a "knockout punch" into Axis-blasting projectiles—loading high-explosive shells as well as armor-piercing bombs—these are the vital war duties of a group of presses built by Watson-Stillman.

At this time we cannot say how many there are, or where they are. But it's no military secret that production schedules for these presses will exceed the specification speeds.

This ammunition-serving equipment takes its place beside many other Watson-Stillman hydraulic presses which are packing a war wallop—those which are straightening gun barrels—those which are bending the keels of tomorrow's transports—those which are producing aircraft parts, powder, and shell forging.

Elsewhere throughout the wartime metal industries, you will find scores of other W-S units—many kinds of presses, high-pressure pumps, jacks, fittings and valves for hydraulic service.

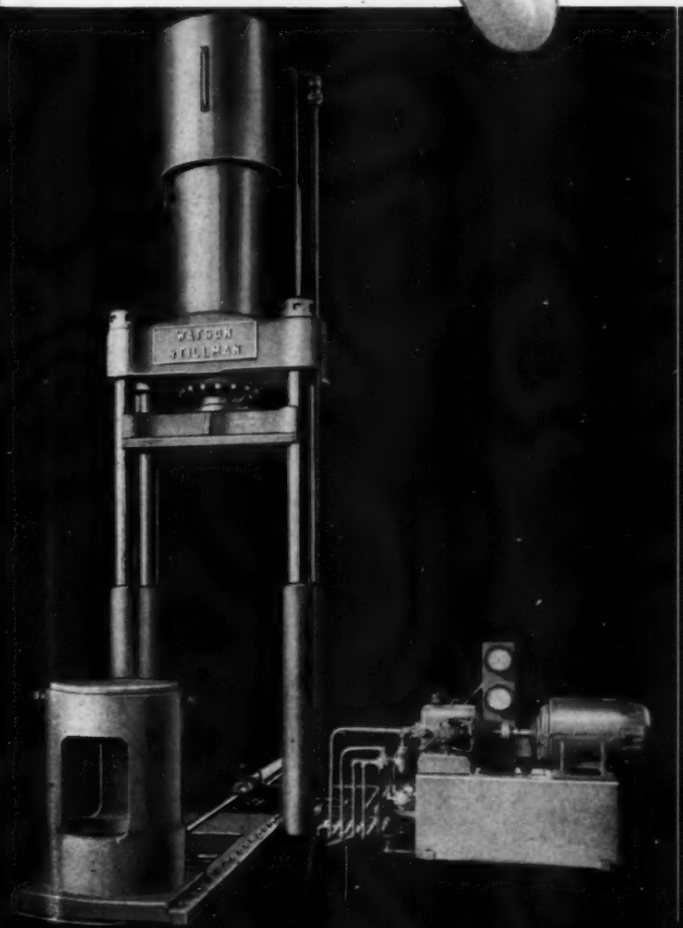
Write for General Bulletin 110A.

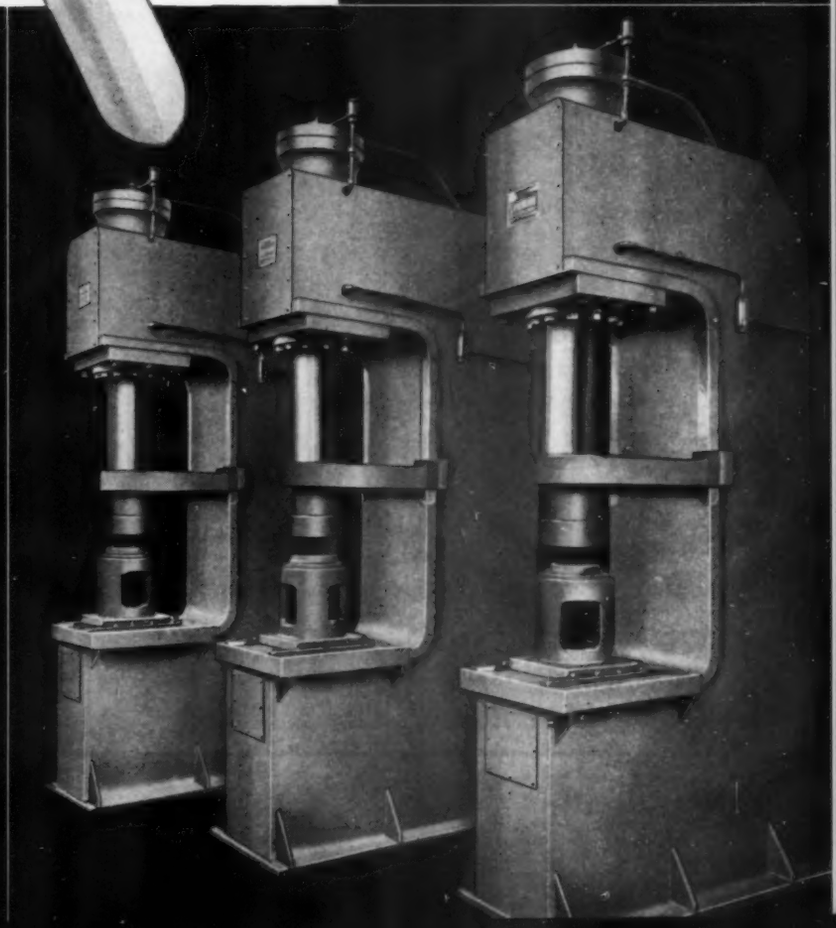
The Watson-Stillman Company
Roselle, New Jersey

WATSON-STILLMAN

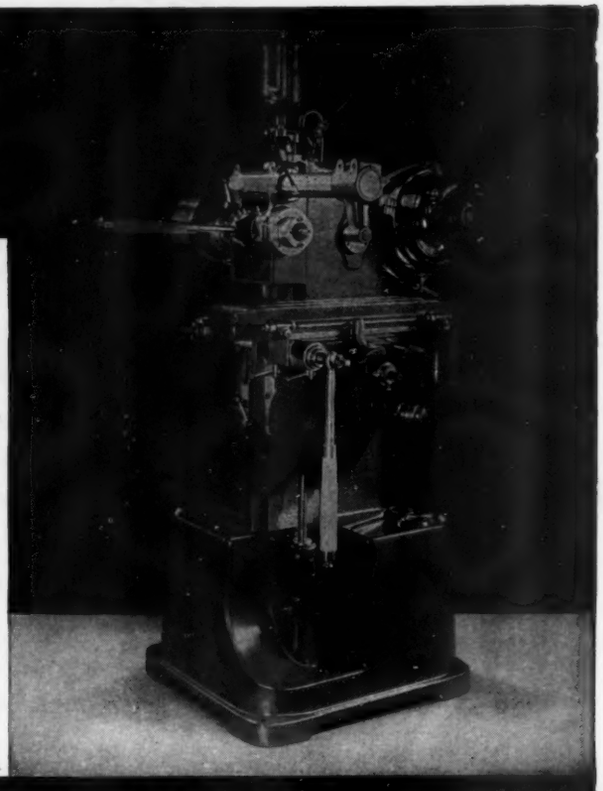
Engineers and Manufacturers of Hydraulic Machinery and Equipment—Hydraulic Presses, Pumps and Jacks, Forged Steel Valves and Fittings

In fact, wherever jobs can be done hydraulically Watson-Stillman serves you





★ ★ STEP UP PARTS PRODUCTION AT LOW INVESTMENT COST



. . . with the

NICHOLS HAND MILLING MACHINE

Substantial savings in production milling are assured by the Nichols Hand Miller—a precision machine which combines the usual features of conventional hand millers with the ruggedness and in-built accuracy of modern high production machine tools.

OUTSTANDING FEATURES INCLUDE:

. . . one piece box section column with adequate slides for head and knee integrally cast

. . . heavy box section. Knee with extra long dovetail slides for both vertical adjustment and horizontal traverse

. . . table, fitted with oil pockets at ether end can be operated from either side of machine and locked in any position; standard equipment includes micrometer table stops; table feed screw optional.

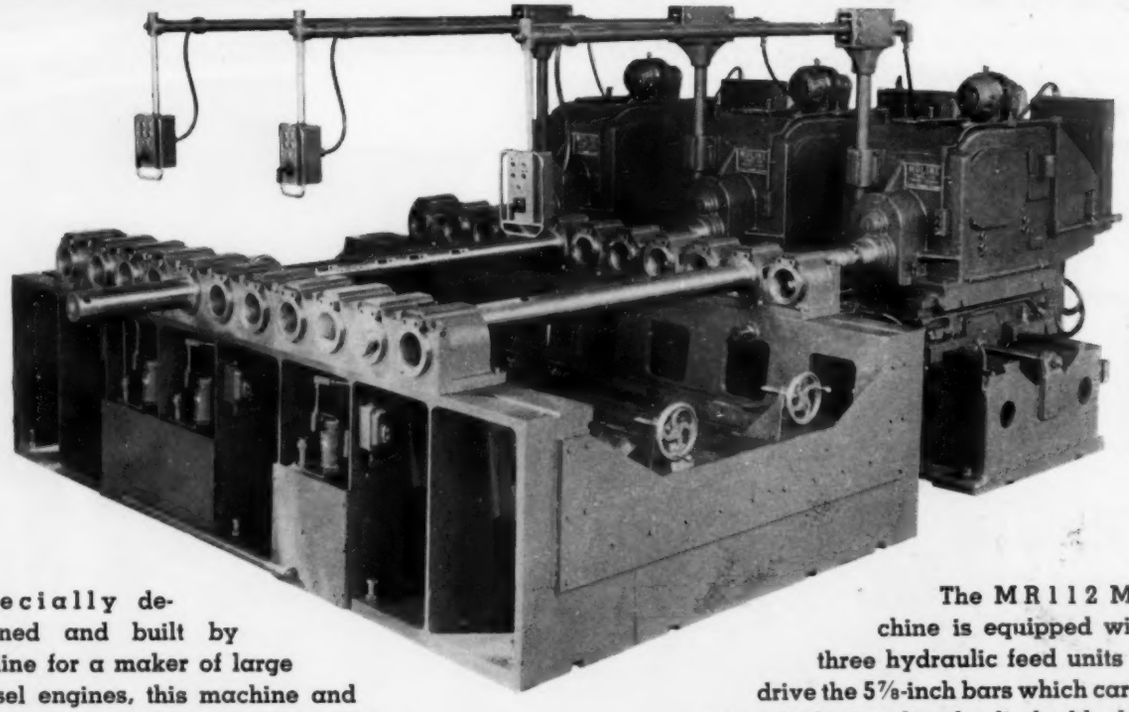
. . . hand operated vertical head fitted with hand set depth stop; can be locked in any position.

. . . spindle hardened and ground mounted on Timken Precision Roller Bearings

. . . capacity: longitudinal feed 10"; traverse feed 7".

» WRITE FOR COMPLETE DETAILED SPECIFICATIONS «

W. H. NICHOLS & SONS *Waltham, Mass., U.S.A.*



Specially designed and built by Moline for a maker of large diesel engines, this machine and fixture require floor area of 15x22 feet.

The MR112 Machine is equipped with three hydraulic feed units to drive the 5⅞-inch bars which carry cutters for boring diesel cylinder blocks.

MOLINE TOOL COMPANY Moline, Illinois

"HOLEHOG"

ESTABLISHED 1901

THESE IMPORTANT FEATURES

all in one machine

help meet and beat production schedules

BALANCED DESIGN:

A balance unit that gives the maximum of service without sacrificing one quality for another.

RIGIDITY:

Firmness that insures high standards of workmanship and production volume.

ACCURACY:

The result of design as well as precision of workmanship, and the quality of materials used.

ACCESSIBILITY:

From either a sitting or standing position, the operator always has a clear vision of the job—one set of simple, convenient directional controls, for both hand and power operation, within easy reach.

VERSATILITY:

Capabilities which greatly simplify many set-ups that would otherwise be difficult to obtain.

PRECISION BORING:

KNIGHT Millers have the necessary requirements for precision boring of jigs and fixtures, and for accurately locating and boring on a production basis where it is not economical to make special tools.

CAPACITY:

Sixteen changes in speed, in either direction, give the spindle ample range to meet a wide variety of requirements.

ALL-PURPOSE KNIGHT Millers

★ You may have a wide range of armament work with speed, accuracy, and quality as definite specifications.

The all-purpose KNIGHT MILLERS with wide capacity give you every advantage in accomplishing production objectives.

There is but a short time required to make a set-up, even the difficult ones. The need for additional set-ups is practically eliminated—where required they are most simple to make.

You get big savings in set-up time because of Universal Table Construction—you need make but a minimum investment in special equipment and tools. You get speed and accuracy for light milling—you get power and rigidity for heavy cuts and you do them in quickest time. Difficult and unusual parts, such as you may now have to machine because of armament work, are handled quickly and accurately without special equipment.

For limited and special production you can keep costs down and maintain quality without special tooling. Internal and external milling is done at one setting.

To know the complete KNIGHT story and the possibilities these millers offer you, ask for Catalog No. 12-40.

W. B. KNIGHT MACHINERY CO.
• ST. LOUIS, MISSOURI •

HOW MANY OTHER PRODUCTION MEN HAVE MY PROBLEM?

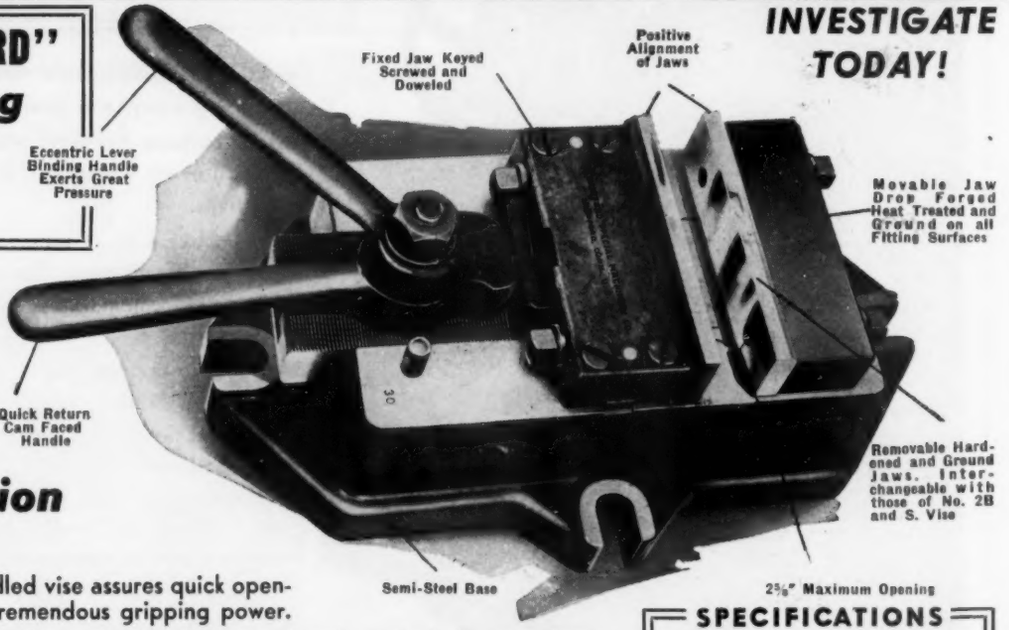
"We're making small parts, thousands of 'em, from the new alloys. We need fast tools and accurate work, high production at a low cost, and machines with a fair capacity. Production schedules require several machines—yet our budget is limited."

You'll find the answer, as this superintendent did, in the
VERNON 11" PRECISION SHAPER
This folder helps to show why!
Write today for your free copy!

MACHINERY MANUFACTURING COMPANY
1915 EAST 51 ST., VERNON .. LOS ANGELES, CALIFORNIA
Vernon Line of HORIZONTAL MILLS, VERTICAL MILLS and JIG BORERS, SHAPERS and GRINDERS

The "HARTFORD" *Quick-Acting* MILLING VISE

INVESTIGATE TODAY!


Fixed Jaw Keyed Screwed and Doweled
Positive Alignment of Jaws
Eccentric Lever Binding Handle Exerts Great Pressure
Movable Jaw Drop Forged Heat Treated and Ground on all Fitting Surfaces
Quick Return Cam Faced Handle
Removable Hardened and Ground Jaws. Interchangeable with those of No. 28 and S. Vise
Semi-Steel Base
2⅝" Maximum Opening

...fast and convenient for small arms production

This time-tested, easily handled vise assures quick opening and return as well as tremendous gripping power.

Two convenient levers, easily manipulated by one hand, control all operations. The lower cam faced lever provides quick opening while the upper eccentric lever exerts the pressure for holding work. Instant opening of jaws for chip clearance or change of work is made possible by merely releasing top lever and giving the lower lever a quarter turn.

The "HARTFORD" will speed up any milling job within its capacity.

SPECIFICATIONS

Jaw Width—5"	Max. Opening (swivel)
Jaw Depth—1-3/16"	Jaws in place—2¼"
Max. Opening (Plain)	Weight—40#
Jaws in Place—2⅝"	Length—13"
Jaws removed—3½"	Width—6"
	Height—5"

THE HARTFORD SPECIAL MACHINERY CO. HARTFORD, CONN.

A SNYDER 3-SPINDLE MACHINE FOR DRILLING ARTICULATED RODS

43845

Small in comparison to the large, complex-operation Snyder machines which have been featured in these pages is this compact unit designed and built by Snyder for drilling oil holes in articulated rods.

And, because it is so extremely compact, this machine again demonstrates the versatility of Snyder engineers in creating machines that will deliver higher production in less space and in less time and with the minimum handling of tools and parts.

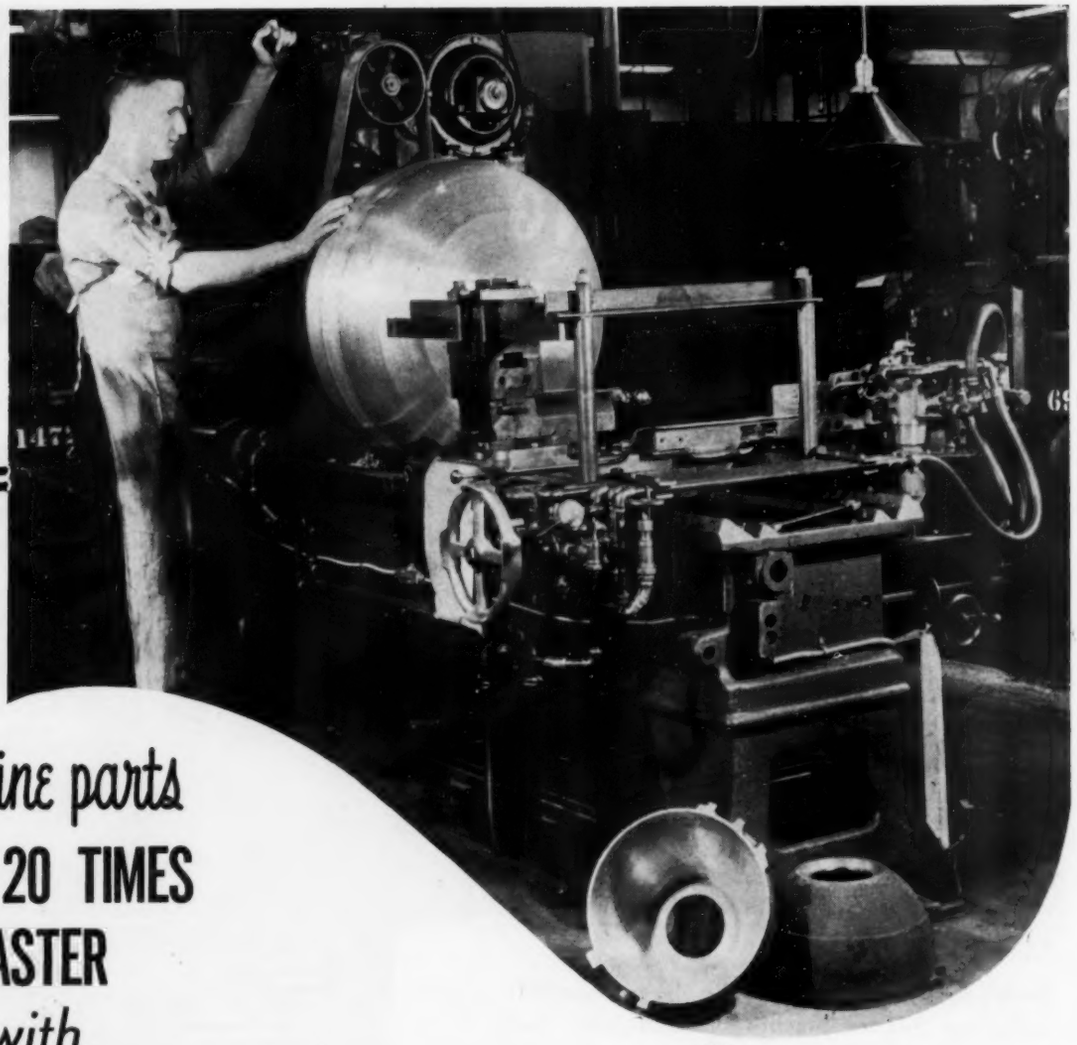
The work-piece is positioned in a manually operated clamping fixture. Drills are held in standard adapters providing adjustment for wear. Spindles are ball bearing mounted in steel quills and are fed into the work from three different angles through a rack and pinion feed mechanism, operated from a single hydraulic cylinder.

The fact that holes of different sizes are drilled without handling of tools or work-piece suggests the substantial savings in production time accomplished with this machine.

If you have a production problem, Snyder engineers may have the answer.

SNYDER
TOOL & ENGINEERING CO.
3400 E. Lafayette Ave. • Detroit

designers and builders of machinery for HIGH *production at* LOW *unit cost*



Machine parts 3 TO 20 TIMES FASTER *with* TURCHAN FOLLOWERS

applied to standard machine tools

TURCHAN FOLLOWERS, applied to available lathes, boring mills, planers and numerous other standard machine tools, are setting enviable production records in many armament plants on large and small jobs.

How is it done? . . . exceedingly simple. TURCHAN design and construction is of such a nature that close work from a thin metal templet, wood or plastic is handled to extremely close tolerances . . . one, two or three dimensional jobs are taken in stride . . . hydraulic controls combined with hydraulic feed add further to the speed and efficiency of TURCHAN FOLLOWERS.

Large jobs . . . small jobs . . . TURCHAN handles them all. Machine gun, tank, aircraft engine parts, are all being machined at a faster rate. And TURCHAN FOLLOWERS can do the same for you . . . we invite your *investigation!*

Above. Large and small bowls are being turned inside and out with two dimension Turchan control. Hydraulic cylinders move both carriage and cross feed. The tracer control valve touching a thin templet reproduces the form as the tool turns the part.

Infinite feed control is at the operator's finger tips while the form is automatically reproduced 20 times faster than previous methods.

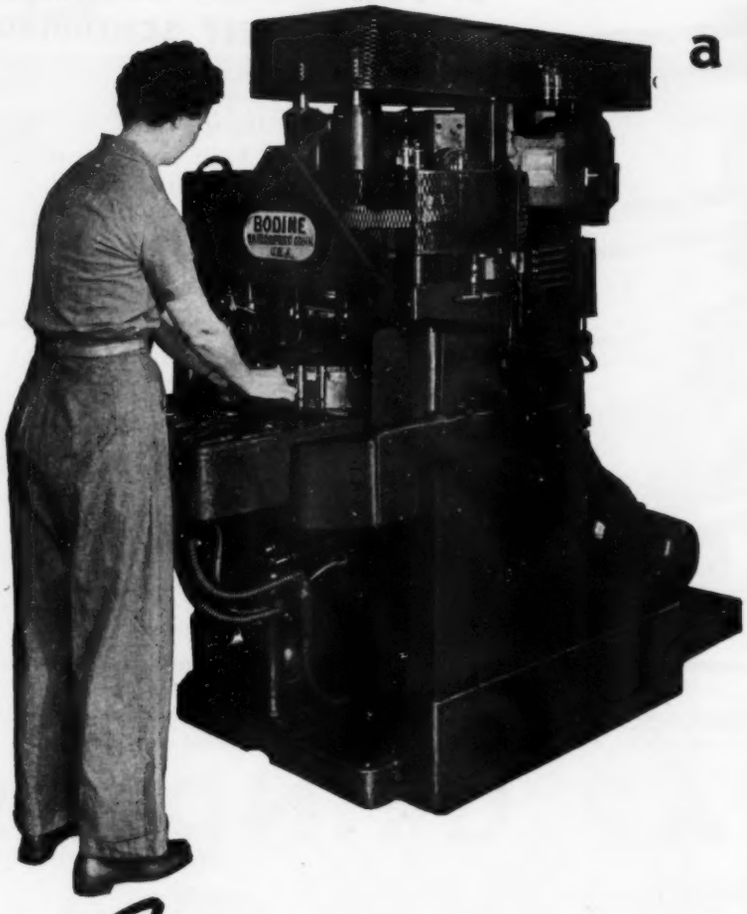
TURCHANS REQUIRE NO SKILLED OPERATORS

TURCHANS CAN BE DELIVERED IN 30 DAYS!

TURCHAN FOLLOWER MACHINE CO.

8259 Livernois Ave., Detroit, Michigan

2 months ago SHE ran a permanent wave machine



In they come . . . from forest and farm, from retail stores and domestic kitchens . . . men, boys, women, girls . . . to answer the call for machine operators in the all-out production of the tools of war.

And today, instead of a 12 months training course, the high efficiency and fully automatic design of modern machine tools enables these new operators to complete training in periods as short as two months.

Quickly trained girls can safely feed and accurately guide the production of the many small ordnance components which machines like the Bodine are producing by the millions.

Multiple spindles operate at progressive stations on the work, held in clamps, on an automatic indexing dial. Automatic protective devices prevent damage to tools, and machine, and minimize the chances of injury to operator.

Because of their simplicity, safety and automatic characteristics Bodine machines are turning out important war products at high speeds, and with extreme accuracy, even under the control of semi-skilled operators.

DRILLING, MILLING, TAPPING, SCREW INSERTING *Simultaneously*

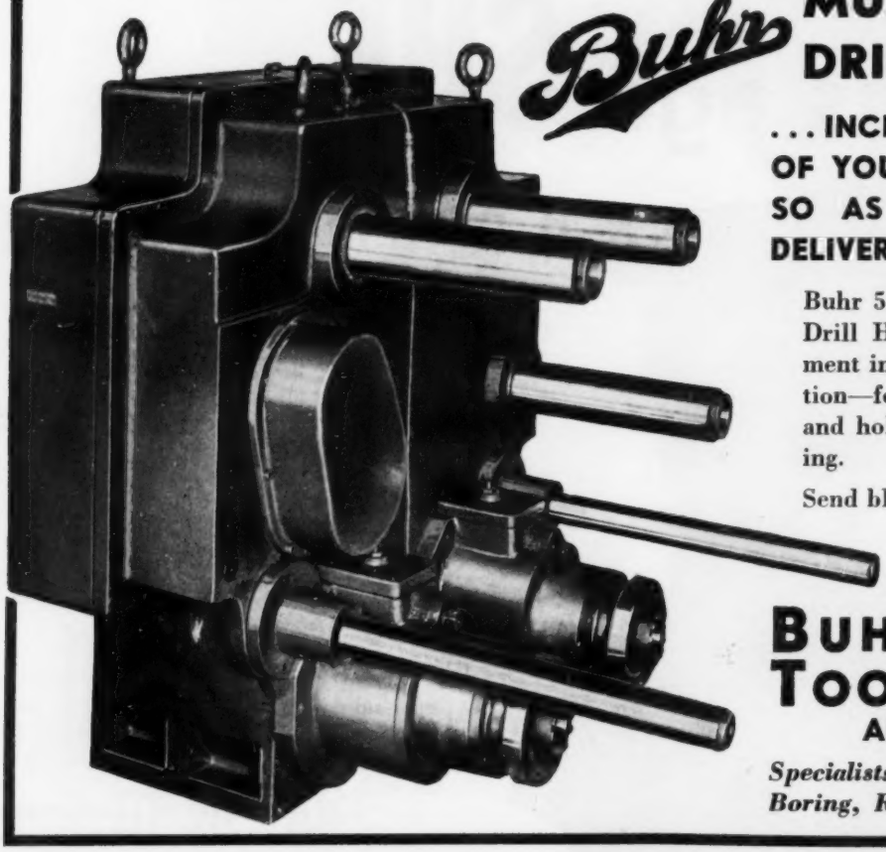
Multiple spindles may be so located that one or all operations of Drilling, Milling, Tapping or Screw Inserting can be performed during a single cycle of the dial. Spindles for Drilling, Milling or Tapping operate vertically, horizontally or from an inverted position. The range of Bodine's 6 sizes permits tapping and drilling holes from the smallest commercial diameters to ½ inch —from 13/16 in depth to 3½ inches.

And one of Bodine's greatest values in crowded production departments is the small floor space required— 54″ x 60″ for the No. 40-10 machine, 90″ x 96″ for the largest Bodine, No. 48-30.

Send for Bodine's new catalog which contains complete descriptions, photographs and specifications of the entire line.

THE **Bodine** CORPORATION
BRIDGEPORT CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES



Buhr

MULTIPLE SPINDLE DRILL HEADS . . . .

. . . INCREASE THE PRODUCTION OF YOUR PRESENT MACHINES, SO AS TO MEET SCHEDULED DELIVERIES!

Buhr 5 spindle Horizontal Heavy Duty Drill Head—48" high—vertical adjustment in all spindles—oil pump lubrication—for 2 way machine—facing, boring and hollow milling holes in axle housing.

Send blue prints . . . we'll make suggestions and recommendations.

BUHR MACHINE TOOL COMPANY
ANN ARBOR, MICH.

Specialists in Multiple, Spindle Drilling, Boring, Reaming, Tapping Equipment.

HYBCO TAP GRINDERS

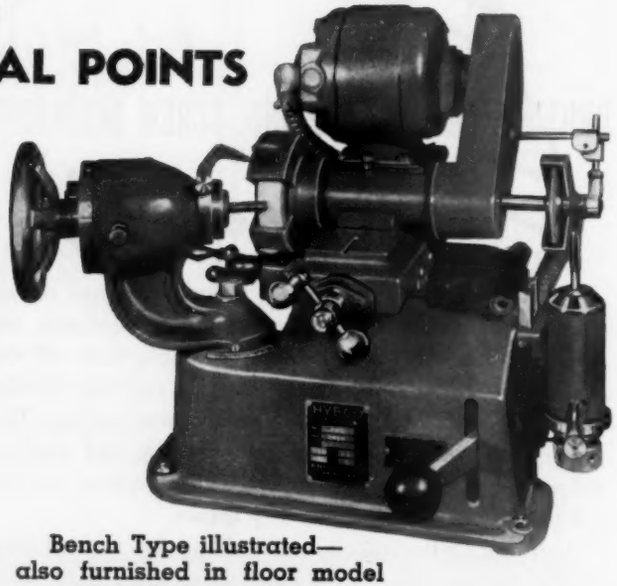
FOR SHARPENING
CHAMFER • FLUTES • SPIRAL POINTS

LENGTHEN TAP LIFE

Get maximum use out of taps—Hybco Tap Grinders can sharpen them even when the center is destroyed. Note these many features—combinations of any number of flutes, right or left hand, can be ground. Belt driven grinding wheel spindle permits use of any type motor. Choice of 3 sizes of chamfer and flute heads include—

#2 to ⅝" hand taps
#6 to 1" hand taps
¾ to 1½" hand taps

Taps can be sharpened after center is destroyed. All sizes held by shank.

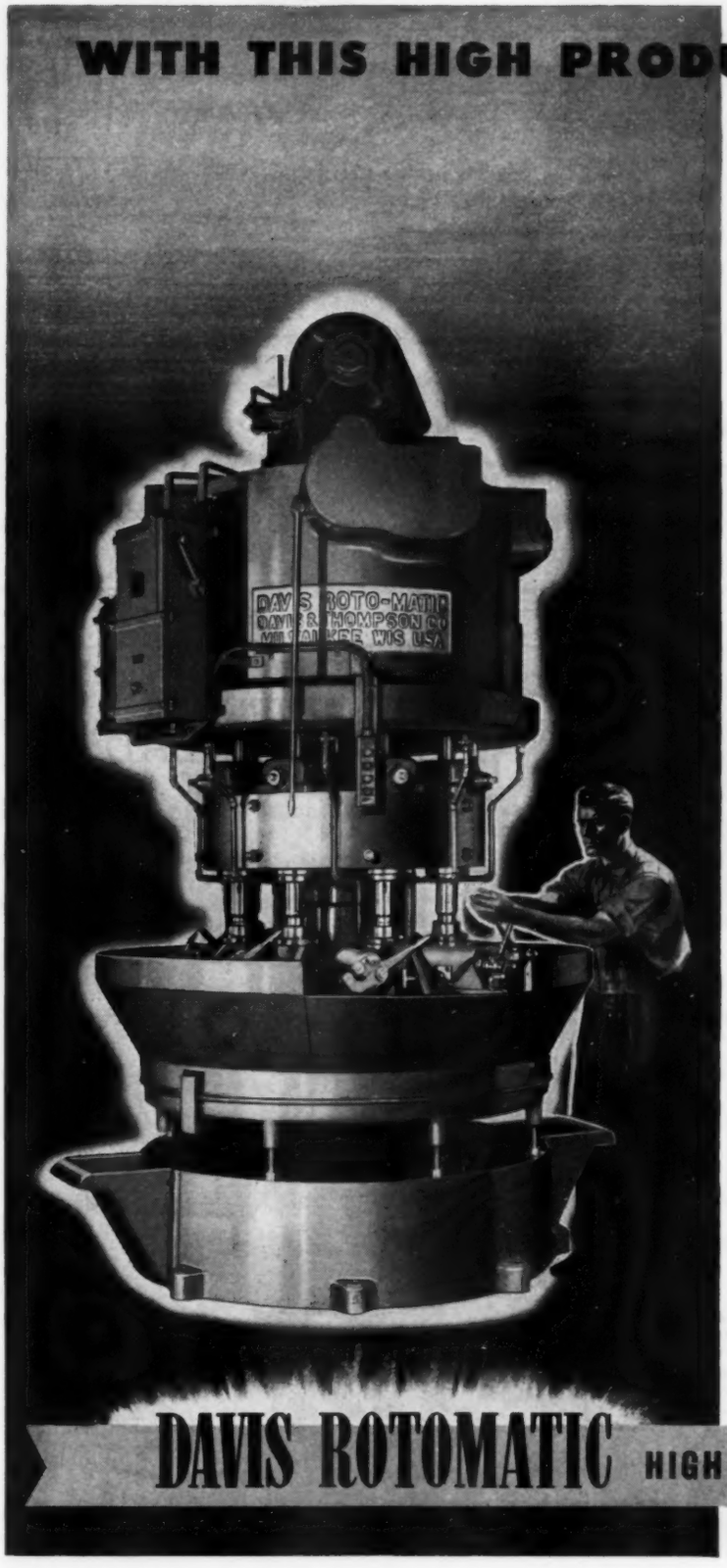


Bench Type illustrated—
also furnished in floor model
and with dust collector.

HENRY P. BOGGIS • • 1279 West 3rd St., • • Cleveland, Ohio

Every Minute Counts—

WITH THIS HIGH PRODUCTION MACHINE



The ammunition and mechanized weapons of modern war now rolling off American production lines in a mighty stream are made possible by high production machine tools like this Davis & Thompson Multiple Spindle Continuous Vertical Drilling Machine and Heavy Duty Miller.

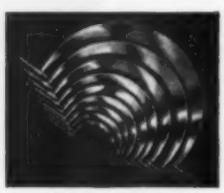
Every minute of the hour counts with this machine — for every hour several hundred detonating fuse points for bombs — are milled by special cutters on this multiple spindle, specially designed and built Davis & Thompson high production machine. Anyone familiar with machining operations will recognize this to be remarkable production performance.

The Davis & Thompson Company specializes in the development, design and construction of high production, metal working machines of which the above is typical. Hundreds of them are in use — machining airplane engine parts, shell and bomb fuses, machine gun barrels, tank track links and scores of other units and parts in war production.

Leading American firms have long depended upon Davis & Thompson—in peace as well as war — for high production machines built with precision and stamina to work day in and day out at top speed, month after month, and year after year.

DAVIS & THOMPSON COMPANY
MILWAUKEE, WISCONSIN, U. S. A.

D & T
Tubular Micrometers
AND STANDARDS
make it easy to be sure of accuracy to the thousandths of an inch on large diameters and bulky, unwieldy parts. Available in 45 different sizes — capacities ranging from 0 to 168 inches.

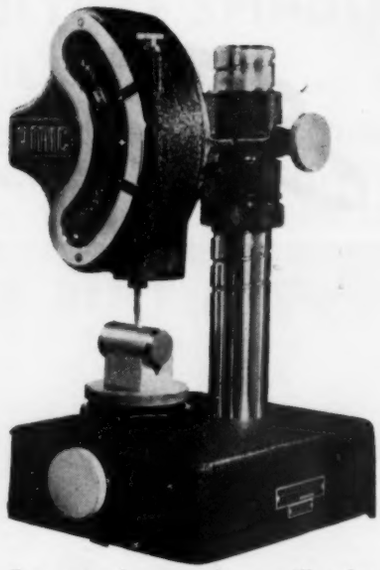


DAVIS ROTOMATIC HIGH PRODUCTION MACHINERY

AMIC COMPARATOR

A Precision Indicating Gage

● Designed to replace special gages, flush pin gages, snap height gages. For accurate, convenient and quick checking of components, either in the tool room or on the production line. Permits precise gaging throughout the whole day without eye fatigue. Each small line on the scale represents 1/10,000th of an inch.



Our extensive experience will solve your measuring problems

A REMARKABLE IMPROVEMENT

Clear reading on 6″ scale, with inch and millimeter readings. Magnification is 1000.

Measuring capacity is plus or minus .003″ and plus or minus .05 mm.

Pointer immediately comes to rest.

Pointer moves in the plane of the scale, thus avoiding any error in measuring due to parallaxis.

Provision for convenient lifting of the contact pin.

Two fine adjustments for easy setting.

Convenient red mark limit hands control tolerances.

Interchangeable backstops and accessories.

AMERICAN MEASURING INSTRUMENTS CORPORATION

40 West 22nd Street, New York, N. Y.

MANUFACTURERS OF GAGES, JIGS, FIXTURES AND SERVICE TOOLS

for ECONOMY—for HIGH SPEED PRODUCTION

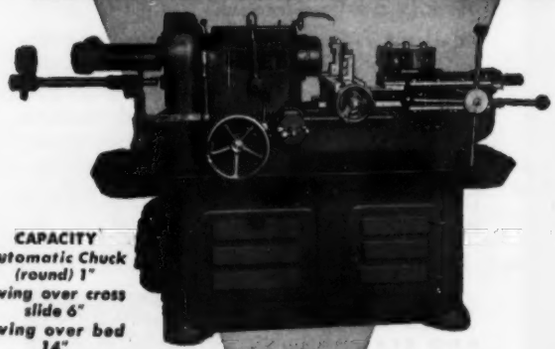
The MOREY 2G

Back-Geared

TURRET LATHE

Timken Bearing

Self-Locking Turret and Infinite Spindle Speeds



CAPACITY
Automatic Chuck (round) 1"
Swing over cross slide 6"
Swing over bed 14"

Thousands of the MOREY 2G Turret Lathes are saving money with no sacrifice of high speed production. Economy features: Back Gears are instantly thrown in through extra large Twin Disc Clutch—Full advantage from high speed and carbide tools—Vibrationless precision and an infinite variety of spindle speeds for every job—Timken bearing—Self-locking turret. Can be furnished with tooling.

Ask for Circular 629 for full details

MOREY MACHINERY CO., INC

410 BROOME STREET • NEW YORK, N. Y.

ERRINGTON

STAPLETON, STATEN ISLAND, N. Y.

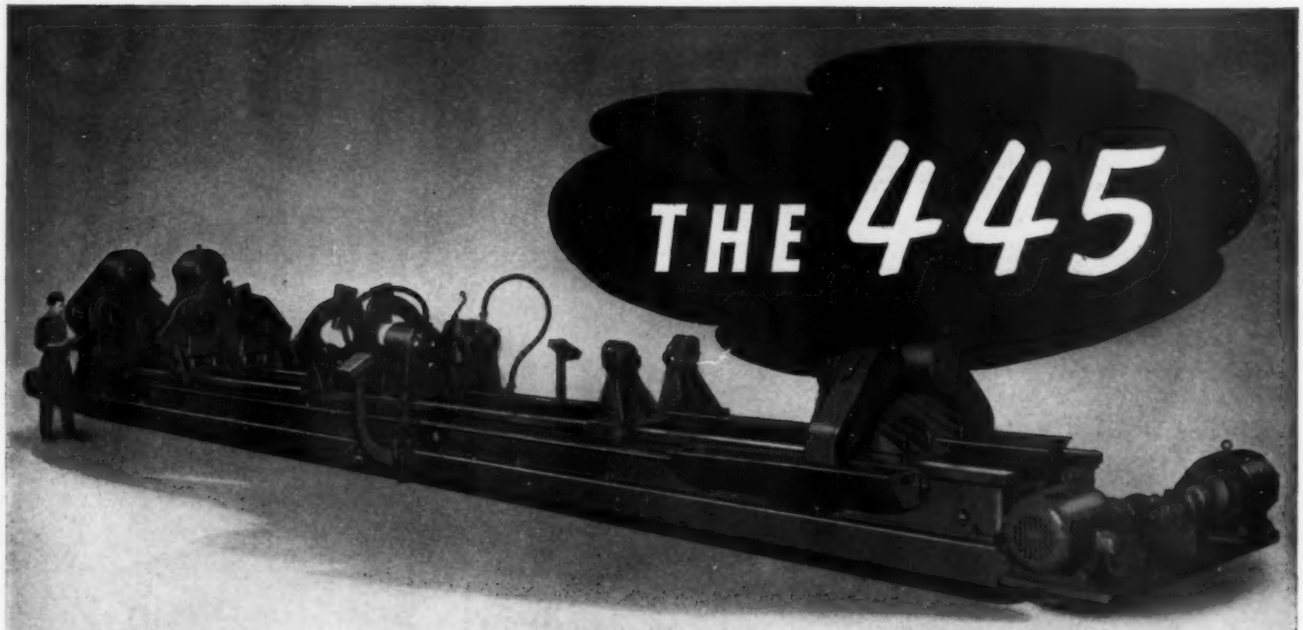
MULTIPLE HEADS

Super-Sensitive Fixed Center Multiple Drilling Heads

Fixed-Center Auto-Reverse Multiple Tapping Heads

All Parts Fully Enclosed to Insure Pressure Lubrication and Rigid Support of Adjustable Spindles

ADJUSTABLE MULTIPLE SPINDLE DRILLING HEAD



DEEP HOLE DRILLING AND BORING MACHINE

ALTHOUGH designed primarily for strut boring and drilling and boring of gun barrels, the W. F. and John Barnes 445 machine is built to handle other jobs within its capacity.

The capacity of this machine is as follows: Stroke — 16′, length of part — 15′-8″ maximum, steady-rests 5″ to 16″ diameter, spindle centers — 26″, spindle height from ways — 20″. Each spindle may be controlled from either of two conveniently located control stations.

Unlike our 410 and 420 Deep Hole Drilling Machines, the tools are fed into the work and the heads remain stationary. The heads are, however, moveable to accommodate various lengths of work-pieces. The spindles, the hydraulically actuated tool slides, and the feed rates of the tools are independent permitting the handling of two dissimilar work-pieces requiring separate feeds and speeds.

Whip supports prevent the springing of the tool shanks at the start of a cycle. These are moved along the ways by the tool slides and are returned to their original positions by cam-operated latches on the tool slides.

WRITE TODAY FOR ILLUSTRATED FOLDER DESCRIBING THE 445 INDEPENDENT TWO-SPINDLE DEEP HOLE DRILLING AND BORING MACHINE.

W. F. & JOHN BARNES

W. F. and JOHN BARNES

310 SOUTH WATER STREET • ROCKFORD, ILLINOIS, U.S.A.

Cemented-Carbide Tipped

INSERTED BLADE MILLING CUTTERS

•

Produced EXACTLY to Required Specifications

Illustrated is one of a number of inserted blade milling cutters being produced by Carbide Fabricators for one of the leading armament plants. It is typical of many now in production use throughout the country.

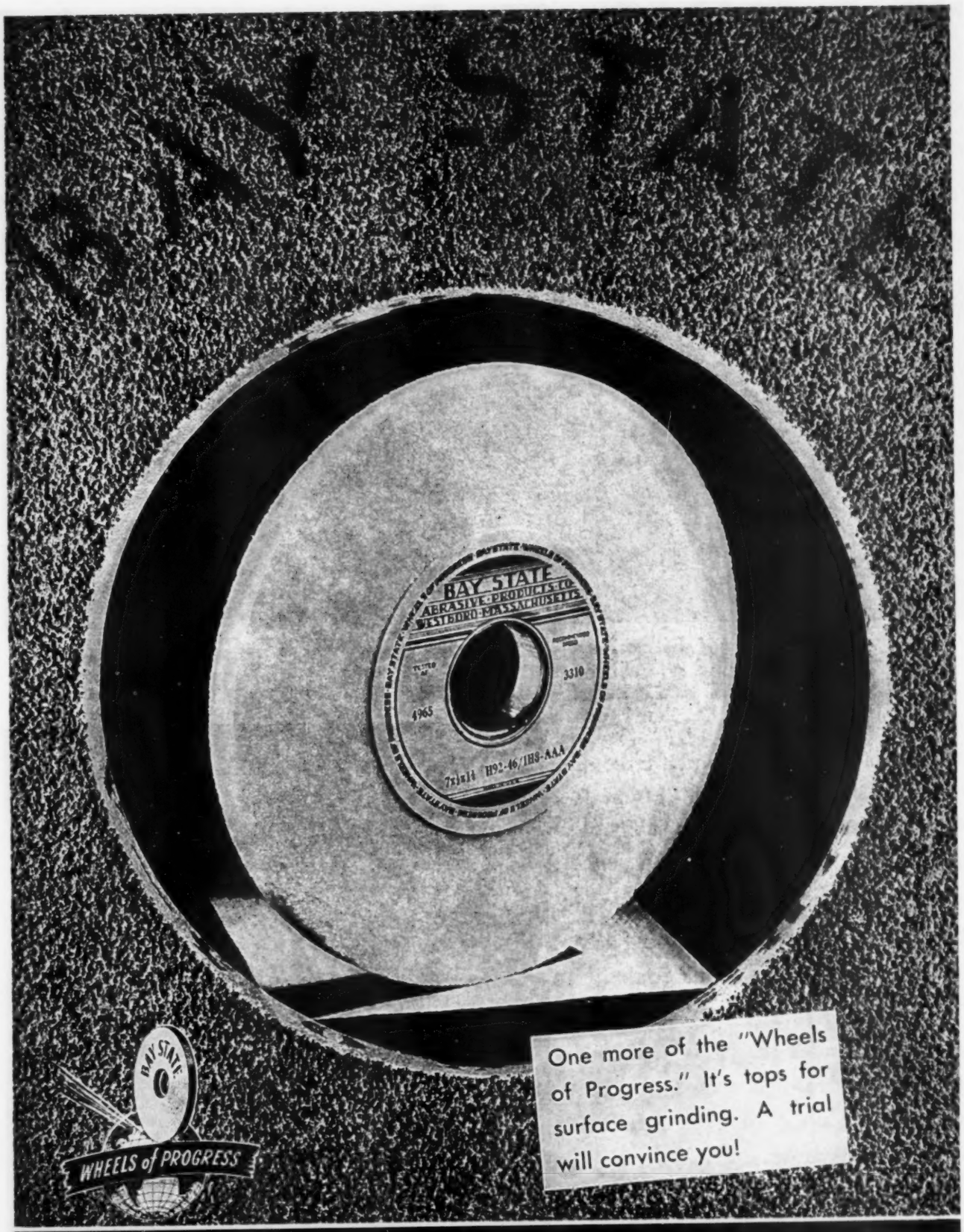
Cutters similar to this can be turned out exactly to your specification by Carbide Fabricators. Outside diameters may be up to ten inches. Your inquiries regarding prices of tools manufactured to meet your needs will be given prompt attention. It is important that blueprints accompany each inquiry.

Manufactured in a New Plant Devoted Exclusively to Cemented-Carbide Work

Every machine in the new, spacious Carbide Fabricators plant is used for the production of cemented-carbide tipped tools. The company personnel—working both day and night—is thoroughly experienced in this specialized work, your assurance of receiving the type of tools that can be depended upon to do your job.

CF *Carbide Fabricators* ROYAL OAK MICHIGAN

DIVISION OF MORSE TOOL COMPANY • DETROIT



BAY STATE

ABRASIVE PRODUCTS CO., WESTBORO, MASS. U.S.A.

PHOTO BY U. S. ARMY SIGNAL CORPS

HOWITZERS AND LATHES

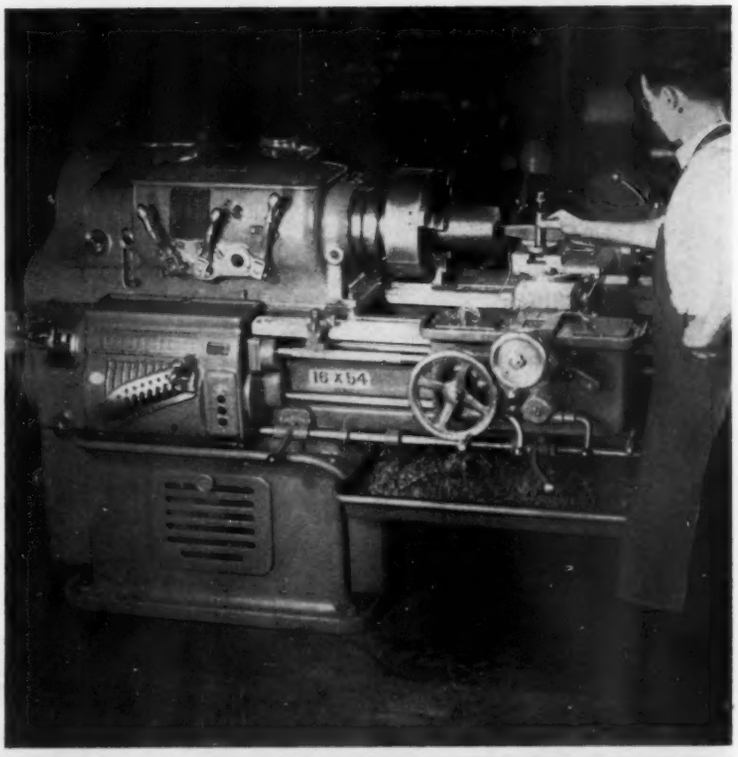
Whether a workman behind a lathe or a soldier behind a gun, both are parts of a vast, interrelated war machine.

Hendey Geared Head Lathes, operated by skilled men in a thousand machine shops, are playing their part in the production of essential war material.

The Hendey Lathe has demonstrated for many decades that it is a smooth operating, precision machine that can be depended upon to give unfailing service.

THE HENDEY MACHINE COMPANY

1874 TORRINGTON, CONNECTICUT 1942



THE HENDEY MACHINE CO., Torrington, Conn., U.S.A.

BOSTON • NEW YORK • ROCHESTER • DETROIT • CHICAGO

35

YEARS OF EXPERIENCE

IN QUALITY PRODUCTION
ARE RESPONSIBLE FOR
THE DEMAND AMONG
EXPERT MECHANICS
EVERYWHERE FOR TOOLS
THAT BEAR THE FAMOUS
NAME OF

PLOMB

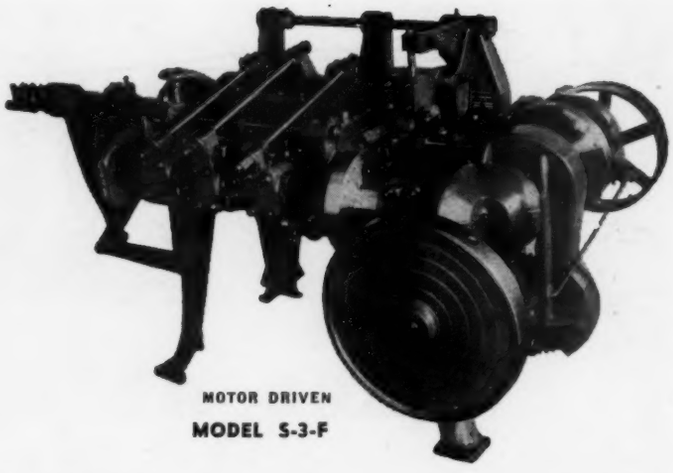
To meet war needs
31
FACTORIES
make them

PLOMB TOOL COMPANY • LOS ANGELES, CALIF.

STEP UP PRODUCTION OF FORMED PARTS

. . . with the

NILSON AUTOMATIC METAL and WIRE FORMING MACHINES



MOTOR DRIVEN
MODEL S-3-F

Today's requirements for higher efficiency, greater speed and products of greater uniformity and accuracy are met in the new NILSON RIBBON STOCK FORMING MACHINES. These machines are the achievement of over fifty years accumulated experience in designing and building metal forming machines. Careful selection of materials and skilled workmanship result in machines that are famous for long life and low maintenance.

FEATURES THAT CONTRIBUTE TO BETTER, FASTER WORK

Superior features of the NILSON four-slide forming machines are the result of long experience and include:

. . . open construction of press and forming tools.
. . . patented slide feed which has an independent cam-operated wire gripping device.
. . . transmission of power operating wire feed through a straight line.

Send for 4-page circular giving further information as well as detailed specifications of sizes and capacities.

• •

We have been engaged in the design and production of special automatic machinery of high production capacity for over thirty years. We are prepared to render a complete service in connection with the design and production of automatic machinery of every description. Consult Nilson on your requirements.

THE A. H. NILSON MACHINE CO. . . . *Bridgeport, Conn., U.S.A.*

NEW ROCKFORD PRESSES

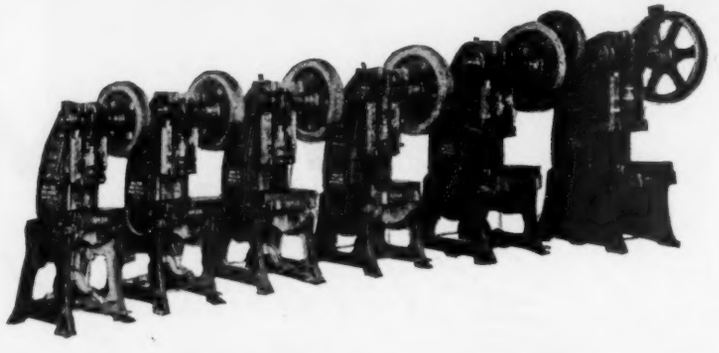
ANNOUNCING!

Removal of our plant and offices to—

6411 W. BURNHAM ST.
MILWAUKEE, WISCONSIN

Prompt deliveries possible on certain sizes

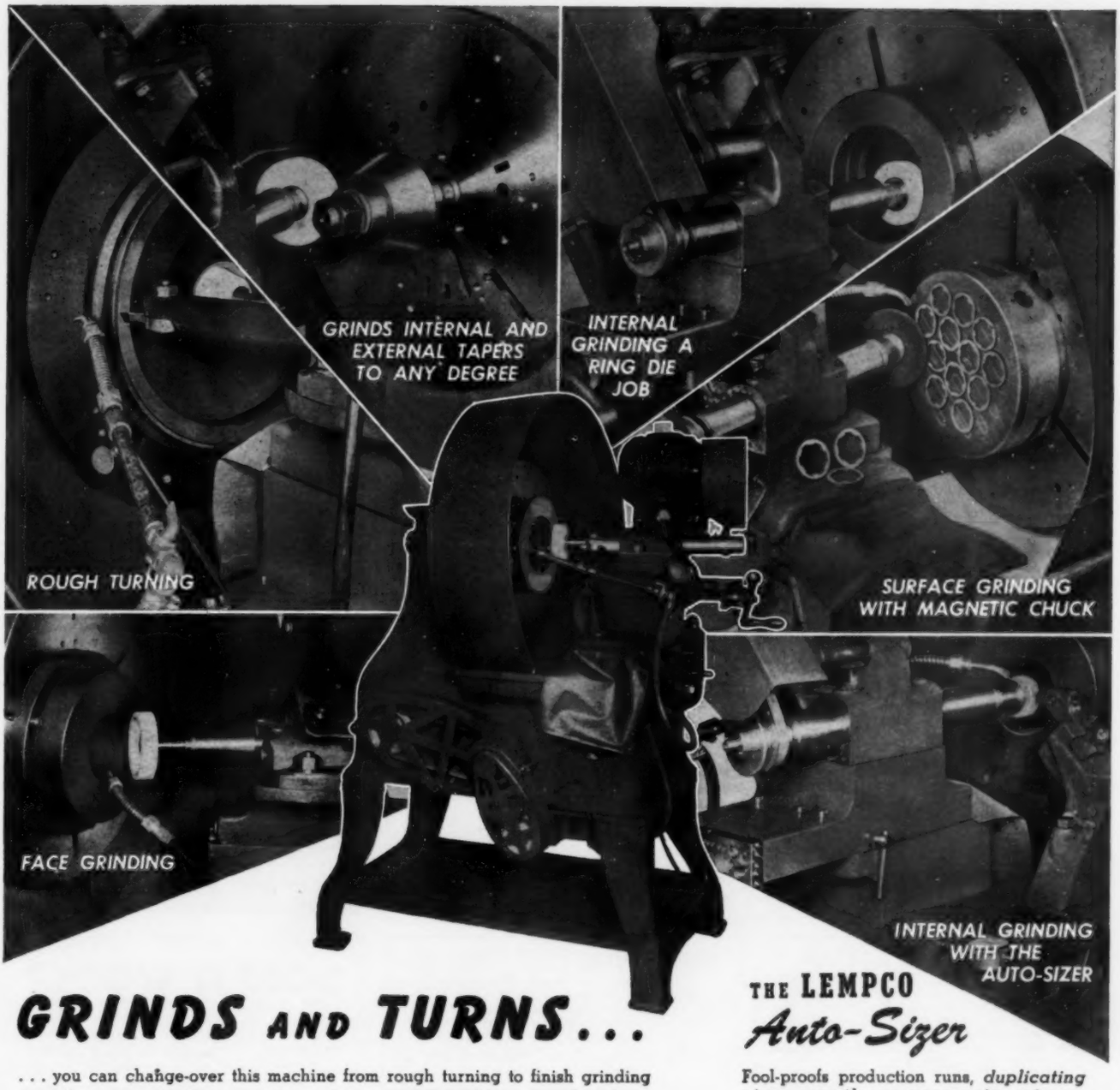
WIRE **WRITE**



The INCLINABLE Line—14 to 100 Ton—
EMBODIES EVERY MODERN FEATURE

DIMENSIONS	1R	2R	3R	4R	5R	5½R	6R	7R	8R
Diameter of crankshaft at bearings and crankpin	1⅞–2¾"	2¼–3½"	2½–3¾"	3–4½"	3½–5¼"	4–5¼"	4–6"	4½–6¾"	5–7½"
Standard stroke of slide	2"	2"	2"	3"	3"	3"	3"	4"	4"
Maximum stroke of slide	4"	5"	6"	6"	7"	7"	8"	8"	10"
Area top of bolster, F to B by R to L	9½x16½"	12x19"	13x22"	14x26"	18x32"	18x32"	21x34"	24x41"	27x45"
Approximate weight Fly Wheel Press	1275	1890	2900	4500	7600	7700	9700	18500	24000
Approximate weight Single Geared Press	1350	2100	3400	5100	8750	8900	10700	20000	25600
Tons pressure (rated)	14	20	26	37	50	56	65	85	100

ROCKFORD IRON WORKS, INC.


GRINDS INTERNAL AND EXTERNAL TAPERS TO ANY DEGREE
INTERNAL GRINDING A RING DIE JOB
ROUGH TURNING
SURFACE GRINDING WITH MAGNETIC CHUCK
FACE GRINDING
INTERNAL GRINDING WITH THE AUTO-SIZER

GRINDS AND TURNS...

. . . you can change-over this machine from rough turning to finish grinding *in a few seconds.* This versatile machine permits finishing several surfaces with but a single mounting, saving set-up time and assuring all surfaces being concentric to one another. Rough turns and finish grinds straight, taper, face or internal jobs up to 30" in diameter, and at production speeds. 7" cross-slide travel and 16" carriage travel handle external jobs up to 27" diameter. Hand-scraped, dove-tailed ways; adjustable tapered gibs; quick-change work speeds; variable quill speeds.

THE LEMPCO *Auto-Sizer*

Fool-proofs production runs, *duplicating sizes exactly on successive pieces.* Grind the first piece to size. Then simply set the "Auto-Sizer" for duplications. When wheel needs redressing, just reset the indicator to zero—which compensates for the abrasive removed—*and keep on grinding without a stop!* Inexperienced women are producing accurate work with the help of the Lempco Auto-Sizer.

★ *Good Delivery! Priorities Can Be Had — Write Us.*

LEMPCO
PRODUCTS · INC.
BEDFORD · OHIO · U★S★A
ESTABLISHED 1919

SEE ONE WORK — MAIL THIS COUPON

LEMPCO PRODUCTS, INC., Dept. AM, Bedford, Ohio
GENTLEMEN: Tell me the plant or shop nearest my place of business where I may see a Lempco Grinder.

NAME.....

ADDRESS.....

CITY..... STATE.....

CONTRACT WORK

Advertisements on this and the following page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

MACHINES AND PARTS,
SPECIAL TOOLS, ETC.

to your specifications

SPECIAL ENGINEERING WORK

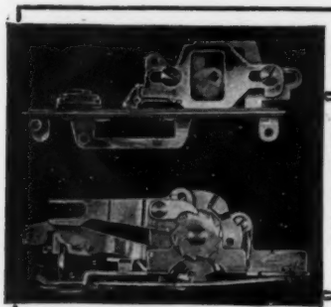
. . . on Contract

It will pay you to investigate our facilities. As designers and builders of wire and ribbon stock forming machines we can offer you skilled and experienced assistance. Send us your blueprints or samples for prompt quotations.

We also solicit your bids for cam milling

THE A. H. NILSON MACHINE CO. Bridgeport, Conn.

METAL STAMPINGS
• TOOLS • DIES •
PERMANENT MAGNETS
HEAT TREATING
THOMAS & SKINNER
STEEL PRODUCTS CO.
1103 E. 23rd St. INDIANAPOLIS, IND.



STAMPINGS and ASSEMBLIES

We can make long or short runs in any metal. Our modern equipment and methods, backed by 50 years of experience, are your guarantee of satisfaction. Our manufacturing facilities also include screw machine products, tools, dies, jigs and fixtures.

Your order is assured of quality workmanship by skilled mechanics. We will furnish prompt quotations on your blueprints or samples. Write us today!

"Greater Savings with Greist"

THE GREIST MFG. CO. 546 Blake Street, New Haven, Conn.

KIRK & BLUM
CONTRACT MANUFACTURING
ACCURATE SHEET STEEL
STAINLESS STEEL, MONEL OR
OTHER ALLOY FABRICATION
OUR SPECIALTY
CAPACITY 3/8" AND LIGHTER
THE KIRK & BLUM MFG. CO.
2823 SPRING GROVE AVE. CINCINNATI, OHIO

MACHINE SHOP

Facilities include 9" South Bend Bench Lathe, #2 Brown & Sharpe Milling Machine, Drill Press and 8"x8" Shaper. The usual line of hand tools and equipment plus experienced workmanship assure your satisfaction. Your inquiries invited.

C. VANDEGRIFT CO.
HOCKESSIN DELAWARE

COMMERCIAL HEAT TREATING

Seasoning of Steel, Nitriding
Centerless, Broach, Thread Grinding
Magnaflux & Optical Testing
Metallurgical & Chemical Laboratories
Cadmium & Hard Chrome Plating

AGERSTRAND CORPORATION
Muskegon, Michigan

DOES IT WORK?

Is the Contract Work Section helping *American Machinist's* subscribers and readers find outside help when they need it? Does advertising in this section really do its job?

If you have idle equipment to put to work, you will want the answers to these questions. You can get them quickly by addressing CONTRACT WORK DEPARTMENT, *American Machinist*, 330 West 42d St., New York, N. Y.

WORK WANTED FOR

Cylindrical Grinder 10"x54", Horizontal Boring Mill 2½" bar, Lathes, Milling Machines, Shapers, Drill Presses, Hand Screw Machines, Foot and Power Presses, Bench.

HAIDA ENGINEERING CO.
24-11 Vernon Blvd. Long Island City, N. Y.

Gray Iron and Semi Steel Castings, also alloyed with nickel, chrome, and molybdenum. Wood, Iron, Brass and Aluminum pattern work.

KING FOUNDRIES, INC.
Phone 823 North Wales, Montg. Co., Pa.
22 Miles from Philadelphia, Pennsylvania

SPUR GEAR AND SPROCKET CUTTING

Have three automatic machines available—range 1" to 6' diameter.

OHMSTEDE MACHINE WORKS
897-899 N. Main St. Beaumont, Texas

PATTERNS in WOOD and METAL
For All Kinds of Castings, Large or Small
MATCH PLATE WORK A SPECIALTY

Put your pattern problems up to us—we will take care of them—ask the foundries about our work—they use our patterns every day.

GENERAL PATTERN WORKS
2233 Buck Street Cincinnati, Ohio

"I need the services of a 42" planer for machining large castings used in the manufacture of machine tools."
—A New York State Concern

Inquiries of this type exemplify the constant need for companies capable of handling contract work of all kinds. You can short-circuit those you are able to handle and assure yourself of your share of sub-contracts through advertising here.

CONTRACT WORK

Advertisements on this and the preceding page are placed here by well-known concerns doing work on a contract basis. When you need assistance write to these established manufacturers.

SUB-CONTRACT FACILITIES FOR

Hand screw machine products.

Engine and bench lathe, milling and drill press work.

Small sheet metal fabrications to closer than commercial tolerances.

Stampings.

We do our own tooling.

RELIANCE MACHINE & MFG. CO.
Thirty Irving Place New York City
36 years experience in metal fabrication.

Our Grey Iron Foundry, Structural and Machine Shops are at your disposal

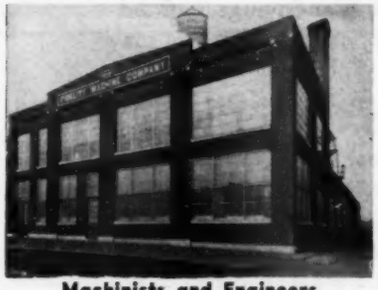
for

Medium Heavy

SPECIAL MACHINERY

CONTRACT WORK SOLICITED

ROBT. HOLMES & BROS., INC.
JUNCTION AVE. DANVILLE, ILL



Machinists and Engineers
FIDELITY MACHINE COMPANY
1908-18 Frankford Ave. Phila., Pa.
Jefferson 7600-1-2

WIRE AND METAL SPECIALTIES
In round, flat, square and special shaped wire in all metals.

LARGE PRODUCTION CAPACITY
Plating and finishing.

EASTERN TOOL & MFG. CO.
BLOOMFIELD, N. J.

DESIGNERS OF
Jigs, Fixtures & Dies
Prompt Service
LAWRENCE W. SECREST CO.
P. O. Box 265
Alexandria Virginia

SUB-CONTRACT WORK

WANTED for any

TUBING, BAR or SHAPE PRODUCTS or SHEET METAL PRODUCTS

Such as—
Conduit, Hydraulic and Pneumatic Lines
Shell Bands
Tubular Gun Mounts
Primer Tubes
Retractable Landing Gears

Such as—
Tank Parts—Chests
Work Benches—Tote Boxes
Ammunition Boxes—Shelving
Machine Tool Tenders—Bench Legs
Drawer Cabinets—Ration Boxes

Machine bases, Pedestals, Frames and Lathe Pans formed and arc welded. Sheet metal fabrication. All kinds of press work. Stampings, Cover plates, Louvre panels. Light and heavy fabrication and assembly. Forming, bending, cutting off and machining of bars, tubes and shapes. No item or quantity too large or too small.

Graduate Engineers on Our Staff for Design Work

AURORA EQUIPMENT CO. AURORA, ILLINOIS
Phone - AURORA 9232

GAGES—PUNCHES—DIES—ETC.
HEAT TREATING FACILITIES
BARTON MACHINE & TOOL CO.
PRECISION TOOL MAKERS
14 Taft Street Pawtucket, R. I.

THE NORLIPP COMPANY
Engineers . . . Manufacturers
Sub-contract facilities for die castings and metal stampings
556 West Congress Street Chicago, Illinois

QUALITY
SCREW MACHINE PRODUCTS
• • •
WALTHAM
SCREW COMPANY
WALTHAM • MASS.

DESIGN & BUILD
JIGS, FIXTURES & GAGES
REED MACHINE & TOOL ENG.
BOX 662
PAWTUCKET, R. I.

SWING JOINTS
for Coolant Line
on
MACHINE TOOLS
QUICK DELIVERY
3/8", 1/2" sizes
Send for Sample
Also Small Brass Castings Machined and Assembled
CENTRAL BRASS MFG. CO.
2950 E. 55 St. Cleveland, Ohio

Over 25 Years Experience Designing
JIGS, FIXTURES, DIES, GAUGES
SPECIAL MACHINERY
Prompt Service—Reasonable Rates
D. M. HELLER ENGINEERING COMPANY
134 N. LaSalle St. Chicago

FOR VICTORY TODAY
AND SOUND BUSINESS TOMORROW

Get This Flag Flying Now!

This War Savings Flag which flies today over companies, large and small, all across the land means *business.* It means, first, that 10% of the company's gross pay roll is being invested in War Bonds by the workers voluntarily.

It also means that the employees of all these companies are doing their part for Victory . . . by helping to buy the guns, tanks, and planes that America and her allies *must* have to win.

It means that billions of dollars are being diverted from "bidding" for the constantly shrinking stock of goods available, thus putting a brake on inflation. And it means that billions of dollars will be held in readiness for post-war readjustment.

Think what 10% of the national income, saved in War Bonds now, month after month, can buy when the war ends!

For Victory today . . . and prosperity *tomorrow,* keep the War Bond Pay-roll Savings Plan rolling in *your* firm. Get that flag flying now! Your State War Savings Staff Administrator will gladly explain how you may do so.

If your firm has not already installed the Pay-roll Savings Plan, *now is the time to do so.* For full details, plus samples of result-getting literature and promotional helps, write or wire: War Savings Staff, Section F, Treasury Department, 709 Twelfth Street NW., Washington, D. C.

EVERYBODY EVERY PAYDAY AT LEAST 10%

Save With

War Savings Bonds

This Space Is a Contribution to America's All-Out War Program by

AMERICAN MACHINIST

OPPORTUNITY NOW AND AFTER WAR

ENGINEER EXPERIENCED IN MACHINE TOOL DESIGN and with special production layouts. Capable of originating designs; also of field engineering with sales force.

Practical experience operating machine tools desirable. For established company with headquarters in Chicago for position handling war machinery problems and qualified for opportunity developing new and special products after war. Compensation in accordance with capability and opportunity for advancement. Replies must be complete and will be kept confidential.

P-347, American Machinist
520 N. Michigan Ave., Chicago, Ill.

CHIEF INSPECTOR

WANTED

With experience on heavy machine parts and tools, in handling of men and instruction in inspection practice in modern, well equipped plant convenient location Metropolitan area. Write full particulars of experience record.

P-352, American Machinist
330 West 42nd St., New York City

SUPERINTENDENT

WANTED

Superintendent. To take full charge at night in a plant manufacturing heavy machine parts. Conveniently located Metropolitan area.

Must be capable of supervising a force of approximately 400 men and have thorough knowledge of machine tool operation. Modern equipment and excellent working conditions. Write, giving background of experience.

P-351, American Machinist
330 West 42nd St., New York City

WANTED

METHODS ENGINEER

Man experienced in estimating and processing general machine shop line of parts that can be handled on turret and engine lathes, all type milling and drilling equipment. Excellent post war prospects with old established company for capable man.

P-353, American Machinist
520 No. Michigan Ave., Chicago, Ill.

WANTED

HYDRAULIC ENGINEER

with both Aircraft and Commercial experience for Development work. Old established company with excellent post war prospects.

P-355, American Machinist
520 No. Michigan Ave., Chicago, Ill.

WANTED

PRODUCTION MANAGER

For eastern gear manufacturing plant. Must have gear experience and ability to supervise production methods. Write full details of past experience, names and addresses of former employers, age, salary and draft status.

P-356, American Machinist
330 West 42nd St., New York City

WANTED

TOOL ENGINEER

Experienced in design of jigs and fixtures for milling, drilling and turret lathe work. Prefer man with actual practical experience. Old established company with excellent post war prospects.

P-354, American Machinist
520 No. Michigan Ave., Chicago, Ill.

POSITIONS VACANT

These Positions Vacant advertisements are published subject to agreement by the advertisers not to consider applicants now employed on war work unless they obtain written release from present employer.

WANTED—DESIGNER for small cutting tools and for jigs, and fixtures. Permanent position. McQuay-Norris Manufacturing Co., Connersville, Indiana.

MAN QUALIFIED to advise correct industrial diamonds, diamond tools, and applications to manufacturing concerns throughout the country. Must have complete, thorough, and technical experience, five years or more with diamond tools, covering all lines of industry using these products. If at the present time employed at highly skilled war work, application cannot be considered. Write giving full information. P-350, American Machinist, 330 W. 42nd St., New York, N. Y.

MACHINE ESTIMATOR and methods engineer. Must know best current practice using carbides on planers, turret lathes, engine lathes, and other general machine tools. State salary and other information. Economy Pumps Liberty Planers, Hamilton, Ohio.

EMPLOYMENT SERVICE

SALARIED POSITIONS — $2,500 to $25,000. This advertising service of 32 years recognized standing negotiates for positions of calibre indicated. Procedure individualized to your personal requirements. Retaining fee protected by refund provision. Identity covered. If salary has been $2,500 or more send for details. R. W. Bixby, Inc., 266 Delward Bldg., Buffalo, N. Y.

Manufacturing Executives and Technical Men, chemists and metallurgists immediate openings throughout country. Salaries $2500 to $20,000 year. Write for application. Confidential. Established 27 years. Harrison Personnel Service, 20 W. Jackson, Chicago.

EMPLOYMENT AGENCY

ENGINEERS—Fine selection of positions open for Manufacturing executives, Production Managers, Superintendents, Foremen, Metallurgists, Chemists, Instrument men, Technical men of all types. The Engineering Agency, Inc., Our 50th year, 53 W. Jackson Blvd., Chicago.

POSITIONS WANTED

GENERAL MANAGER — Mature, Profit-minded, Dependable. Has successfully managed four companies—two taken out of the red. Available for service shortly with medium size company requiring reliable directing ability in management, sales, finance and production. Excellent experience machinery, tool, foundry and related lines. PW-318, American Machinist, 330 W. 42nd St., New York, N. Y.

EXECUTIVE ENGINEERS, employed by long established firm management engineers, desires permanent responsible position. Sound experience in organization, production, costs, policies, products. University graduate. PW-358, American Machinist, 330 W. 42nd St., New York, N. Y.

Don't forget

THE BOX NUMBER . . .

when answering the classified advertisements in this magazine. It is our only means of identifying the advertisement you are answering.

SELLING OPPORTUNITIES

OFFERED—WANTED

Selling Agencies—Sales Executives Salesmen—Additional Lines

OPPORTUNITIES OFFERED

SALESMAN to sell new improved machine tools on commission basis, also jobbers, Tietzmann Engineering Co., 1043 Highland Ave., Dayton, Ohio.

SALESMEN WANTED throughout country calling on tool-room and grinder foremen to carry a side line of greatly improved diamond point wheel dressers and diamond tools. Please write SW-343, American Machinist, 330 W. 42nd St., New York, N. Y.

PATENT ATTORNEYS

PATENTS—Booklet free. Highest references. Best results. Watson E. Coleman, Patent Lawyer, 724 Ninth Street, Washington, D. C.

PATENTS, COPYRIGHTS. Booklet. "General Information Concerning Inventions and Patents" and "Fee Schedule" send without obligation. Established 1915. Lancaster, Allwine & Rommel, Suite 453, 815-15th St., N.W., Washington, D. C.

CONTRACT WORK

WORK WANTED — For advertisements of work wanted see names indexed under Contract Work in the Searchlight Section Index appearing on page Facing inside back cover.

TOOL SPECIALTY SALESMEN WANTED

Our Product bears AA and AAA rating, priced from $50.00 to $100.00 each and is used extensively for Maintenence and Building of Ships, Tanks, Airplanes, Trucks, Motors, by Railroads etc. In reply, tell us the territory you cover, for how long, the products you now sell and some leaders you contact.

Girard Manufacturing Products, Inc.
Maywood, Illinois

ALFRED HERBERT LTD. COVENTRY, ENGLAND

OFFICES AND SHOWROOMS AT—LONDON, COVENTRY, GLASGOW, MANCHESTER, BIRMINGHAM, SHEFFIELD, BRISTOL, NEWCASTLE, CALCUTTA, BOMBAY, SYDNEY MELBOURNE, BUENOS AIRES

representing a number of leading United States makers of machine tools and workshop equipment can undertake additional agencies.

WANTED

NEW INVENTIONS WANTED

Mechanical and electrical devices which can be used to promote our war production program. Either new ideas, or improvements upon present methods.

P. O. Box 217, Denville, N. J.

SEARCHLIGHT SECTION

AMERICAN MACHINIST

UNDISPLAYED RATES

Positions Vacant and other classifications—10 cents a word, minimum charge $2.00 an insertion. Allow 10 words for box number address. No additional charge for forwarding replies.

Positions Wanted—½ of the above rates.

Discount of 10% for full payment in advance for 4 consecutive insertions of undisplayed advertisements.

Proposals—50 cents a line.

DISPLAYED RATES

Space is sold by the advertising inch (measuring approximately ⅞ inch deep by 2¼" wide). 3 columns—30 inches—to a page. Rates start at $6.50 per advertising inch.

AUTOMATICS
14"x19" Fay
No. 6A Potter & Johnston
Nos. 33, 34 and 454 New Britain
4½" Gridley model H
6"x6¾" Goss & DeLeeuw
1" Cleveland "J" double end
No. 16 Gisholt simplimatics
10" Bullard "Vert-au-Matic"

BROACHES
Nos. 1, 3 and 4 LaPoint screw
No. 3 LaPoint double screw
No. 2 Standard screw press
2 ton American rack vertical

DRILLS
15", 20", 21" Buffalo
20", 22½" and 26" Barnes
21" and 25" Superior
20", No. 210 Barnes heavy
24" Barnes all geared
20" No. 23 Foote Burt
21" Cincinnati manufacturing
Natco multiple Nos. 11, 12, B12, C12, 14 and 32, 8 to 62 spindles
No. 1 Baush multiple
No. 13 Pratt & Whitney multiple
Nos. 15½D and 15½F Foote Burt manufacturing
No. 8H Natco hydraulic horizontal multiple
Barnes vert. mult. hydr.
8 spindle No. 6 Moline Holehog
Nos. 0 and 00 Garvin duplex
4"x10" Sundstrand centerer
4' Hammond radial
Sensitive drills. Almost all makes and sizes

FORGING & STRUCTURAL
1½" Acme upsetters
2½" and 4" Ajax upsetters
2" National upsetter
No. 1A Ajax forging rolls
No. 4 Torrington swager
No. 6H8 Langelier swager
60 lb. Bradley helve hammer
150 lb. Nazel air hammer
No. 1 Rock River bulldozer
No. 29 Williams White bulldozer
12", 1½"x1" Cleveland horizontal punch
12", 1¼"x1" Long & Alstatter punch
26", ¾"x¾" Rock River punch

GEAR MACHINERY
Nos. 3 & 12 Barber Colman
No. 18 H Gould & Eberhardt
Nos. 1 & 5A Lees Bradner
26"x48" Brown & Sharpe automatic
30" Flather automatic
36" Gould & Eberhardt automatic
60" Cincinnati automatic
Nos. 6, 61 & 62 Fellows shapers
18" Gleason testers & lappers
15" Gleason spiral gear rougers
Gleason spiral pinion rougher
18" Gleason bevel generator
2 spindle Lipe chamferer
Pratt & Whitney worm grinder
National gear checker

GRINDERS
10x36 x 10x50 Norton
12x36 Landis
12x36 Cincinnati
Capitol internal
Nos. 6 & 15A Bryant internal
12"x36" Diamond surface
20"x50" Safety surface
Nos. 50 & 60 Heald cylinder
18", 24" & 52" Gardner disc
24", No. 84 Gardner opposed disc
17"x36"-48" Norton hydraulic crankshaft
Gisholt tool grinder
24" Ingersoll tub type
30" Ransom elect. snagging
16" Norton snagging
2¼" Wil. & Morman drill
Type 15 Norton lapper
No. 575 Hawes tub polisher
20" & 36 Wet Tool

LATHES, TURRET
28" Steinle, 8" hole
24" Steinle 6¼" hole
22" Steinle, 3-9/16" hole
22" Libby, 4½" hole
2¼x24 & 3"x36" Jones & Lamson
Double spindle Jones & Lamson
14"x6' Lodge & Shipley with turret
No. 2 Acme
No. 2 Southworth
No. 2 Warner & Swasey

LATHES, MFG.
11"x3' South Bend, OCG
13"x20" Seneca Falls "Short Cut"
13"x6' Automatic threading
20"x8'6" Wickes mfg.
Melling camshaft
Melling crankshaft
28"x9' centers Bridgeford axle
3¼"36" Lo Swing

MILLS, BORING
3⅞" bar Beeman & Smith horiz.
4-15/16" bar Barrett cylinder boring
36" Niles vert. car wheel borer

MILLING MACHINES
No. 3 Turnmilling for round work
Nos. 1 & 1A Davis & Thompson drum type duplex
48" Oesterlein tilted offset
Nos. 10 & 45 Productomatic
No. 6 Whitney hand
12" Pratt & Whitney automatic
Model AB Becker vertical

PLANERS & SHAPERS
24"x24"x5' Gray
24"x24"x6' Woodward & Powell
29"x29"x6' New Haven
36" Morton draw cut shaper
12" Dill vert. shaper or slotter

PRESSES
No. 5 Bliss Consolidated OBI
No. 5½ Niagara OBI
Nos. P2 & PA3 Ferracute
Nos. 14½ & 41A Toledo horning
Nos. 6 & 6½ Wat. Ferrel gap
No. 76 Toledo gap frame
No. 62 Bliss gap frame
No. 38½ Bliss straight side
No. 53 Toledo straight side
No. 8-7 Zeh & Hahnemann S.S.
No. 7 Rockford straight side
No. 4 Massillion straight side
No. 2 Standard screw type
28", No. 71 Swaine dbl. cr.
No. 6A Bliss cam drawing
No. 180 Toledo toggle drawing
No. 796¼ Toledo double crank toggle drawing, 108" bet. upr.
750 ton Baldwin Southwark triple action hydraulic toggle, 142½" between uprights

RIVETERS
Nos. 3A, 4A, 5½B & 7B High Speed
No. 80 Grant
20 ton Allen pneumatic

SHEET METAL TOOLS
4'x3/16" Cincinnati press brake
12'x10 ga. Ohl press brake
4"x3/16" Bay City band roll
No. 352 Toledo band roll
Nos. 1 & 2M Pettingell hammers
⅜"x3' and 5' Shuster wire straightt-ener & cutter
Sleeper & Hartley casing coiler
No. 5 Sleeper & Hartley spring coiler
No. 3 RH Magee Wirer

SHEARS
No. O-15 Stanley Uni-Shear
No. 225 A Bliss slitter
18" Pels beam
2" Newbold guillotine
1½" Lewis alligator
2" Hilles & Jones alligtaor

TAPPERS
⅝" National precision nut
Nos. 1 & 2X Garvin
Natco lead screw, 1 & 2 way
1½" National 6 spindle nut

THREADERS
½"x3" Wat. Farrel thread roller
½" Acme double head
¾" Economy
1½" Geometric
2" Landis double
2" Landis pipe & Nipple
2" Rogaco pipe mach.

MILES MACHINERY COMPANY, Saginaw, Mich.

LATHES
16" x 10' Monarch Cone Drive, Q.C.
18" x 6' American Grd. Hd. 8 speed M.D. Turret on shear Q.C.
18" x 8' L & S Patent Head Lathe, M.D. Q.C.
26" x 14' Putnam Engine Lathe, Cone Head, Q.C.
36" x 16' Lodge & Shipley Selective Geared Head Lathe.
40" x 20' McCabe Lathe, Cone Drive, Trip. Grd.
56" x 18' Putnam Turning Lathe, Belt feed.

GRINDERS
14" Pratt & Whitney Vertical Ball Baring Spindle.
16" x 60" Modern Plain Grinder.
16" x 72" Landis Plain Grinder, Self contained.
Fitchburg Spline Shaft Grinder.

MILLERS
#1 P & W Hand Miller.
#4 Cincinnati Vertical, Single pulley drive.
18" x 18" x 9' Beaman Slab Miller.

MACHINERY
18" Gleason Bevel Gear Generators.
6" Bilgram Bevel Gear Generator.
#00 Pfauter Gear Hobber.
#1 Adams Gear Hobber.
#1 Schuehardt & Schutte Gear Hobbers.
18H Gould & Eberhardt Gear Hobber.
Lees Bradner Gear Grinder.

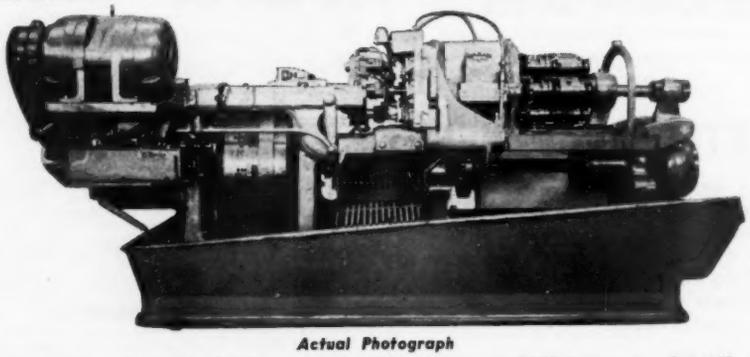
MILLS
62" Colburn Vertical Boring Mill.
10' Pond Boring Mill.

PLANERS
32" x 32" x 18' Gray Planer, 2 Heads.
36" x 36" x 8' American Planer, 2 Heads.

CINCINNATI MACHINERY & SUPPLY CO.
217 East Second St. Cincinnati, Ohio

Now Available—

NEW BRITAIN CUTOFF MACHINE



Actual Photograph

Capacity of chuck: 1⅝" round, 1.149" square, 1.407" hexagon. Length of feed 7".

Arranged for motor drive with 10 H.P. motor. Weight approximately 10,400 lbs.

A high speed cutoff machine that can be used for forming and cutting off. It can be readily set up for use on small lot production.

Your inspection is solicited

LOUIS E. EMERMAN & CO.
1761 Elston Ave. Chicago, Ill.

BROACH, No. 2 LaPointe, M.D.
GEAR CUTTERS, Spur, 30", 36" & 40" M.D.
GEAR PLANERS, Bevel, 36" & 54" Gleason, M.D.
GRINDER, 18' x 30' x 96' Norton Cyl., M.D.
LATHE, Driving Wheel, 78" Bement, Dbl. End.
PRESS, Hydr., 1000 ton Wood, platen 42" x 9'.
SLOTTER, 15" Dill Table Dia. 34".
STRAIGHTENER, 12-roll Kane & Roach, M.D.

LANG MACHINERY COMPANY
28th St. & A.V.R.R. Pittsburgh, Pa.

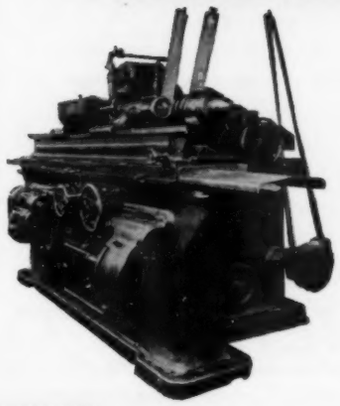
METAL PLANER
36"x36"x14' WOODWARD & POWELL Metal Planer, one head on cross rail and one side head. Width of table—32¼".
Thickness of table—4½".
Equipped with power lift for the cross rail.
Arranged for self-contained belted motor drive, including motor platform and countershaft.

ALSO MANY OTHER TOOLS
ALEX ZEEVE & COMPANY
2269 Woolworth Building New York, N. Y.

POWER PRESSES
BLISS, TOLEDO, V & O, ETC.
REBUILT — GUARANTEED
JOSEPH HYMAN & SONS
Tioga, Livingston and Almond Streets
Philadelphia, Pa.

When You Need Machine Tools Check "FALK'S" Stock

"FALK" for DEPENDABILITY in Rebuilt Machinery



COMPRESSORS

Gardner, 4½ x 4½, duplex
Bury, 8 x 8
Curtis, Verticle, duplex, 8 x 8

BRAKES

Dreiss & Crump 8' x 14 gauge
Dreiss & Crump hand brake, 8' x 18 gauge

GEAR CUTTER

Gould & Eberhard, 36" arranged motor drive

RADIAL DRILLS

2—Niles, Bement-Pond, flat column 5' arm
Niles Bement Pond, flat column 6' arm

GRINDERS

Gorton, double end disc grinder, 18" discs
#51 Oliver drill grinder, M. D.
Sellers drill grinder
#1 Le Blond tool and cutter grinder

RIVETING MACHINES

#4A Grant riveting hammer, 5/16" capacity

DROP HAMMERS

2—Standard Automatic, 100 lbs.
Standard Automatic Belt drop hammer, 200 lbs.

TURRET LATHES

#4 Warner & Swasey, 1½" capacity.
#6 Warner & Swasey, 2¼" capacity
21" x 3¾" Hole—Gisholt Universal

MILLERS

#1 Le Blond Universal Miller
Sanford production Miller
#7 Becker production Miller

THREAD ROLLERS

2—#10 Waterbury & Farrell thread rollers
2—#0 Waterbury & Farrell thread rollers
2—#30 Waterbury & Farrell thread rollers
2—#32 Waterbury & Farrell cold headless & double Stroke solid die
#33 Waterbury & Farrell cold headers & double stroke solid die

TRIMMERS

2—Waterbury—Farrell Automatic Trimmers ⅝ cap.

Pratt & Whitney Duplex miller
Hall planetory thread miller
Lees Bradner thread miller, 54"
Taylor & Fenn Verticle milling #7 B&S taper
2—Type A Gooley & Edland production millers, m.d.

PRESSES

#3 Niagara 1½" stroke
#3 Baxendale, 2" stroke
#2 Baxendale 1½" stroke
#16 Niagara horn press, geared, M.D.
#44 V. & O. horn press geared, M. D.
#62 Bliss reducing press, Henry & Wright press, 25 ton, General Fixible press, 3 ton
#65½ Consolidated punch press, straight side

SAWS

Hunter friction Saw, motor driven, 16" blade
Peerless, saw size 10x10
Racine Saw size 9x9

SHEARS

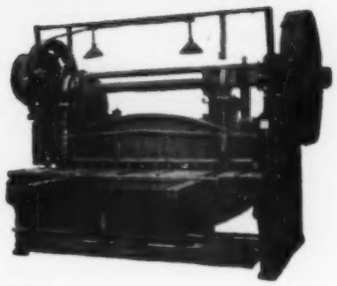
Pexto foot shears, size 36" x 16 gauge
156" Hyde Park, ⅝ cap. 18" gap, M.D.
156" United Foundry & Eng. Co. ¼" cap. 18 gap, M.D.

PLATE SHEARS

156" Mesta Eng. Co. ½ cap. 15 gap, M.D.
#262 Niagara, 60", 14 gauge, arranged motor drive

LATHE

36" x 24' Pond triple geared, heavy duty Engine lathe, plain change gears
14 x 6' Rockford, semi quick change gears
18 x 10' Rahn Larmon plain change geared lathe
20" x 12' Mueller, quick change gear, with Taper attachment
10" x 24" New Logan lathes, with collets, etc.



TAPPERS

#2 Garvin Tapper

THREADERS

14—Chicago automobile Venticle threader 2 spindle

UPSETTERS

Acme upsetter 1" cap.
Acme upsetter 1½" cap.

BORING MILLS

60" American, heavy duty, verticle boring mill
2 swivel heads, self contained belt drive Friction feed
#1 Barrett Horizontal boring and facing mill 3⅜" bar, with facing head.

DRILLS

3—Barnes drill 20" cap. #3 Morse Taper
3—Buffalo Forge drill 20" cap. #3 Morse Taper
Avey drill, two spindle #2 Morse taper
Avey drill three spindle size ½
Cincinnati 24" upright heavy duty

MISCELLANEOUS

Abbott burnishing barrel 8" x 36"
Degreaser size 48" x 21" x 20"
Torrington Slitter, for tin plate, 3 sets of cutters
Blakeslee metal washer

PRESSES

No. 4 Bliss, double Crank, geared forging press.
2—No. 4½ Bliss double crank geared forging press
2—No. 4½ S Bliss, three column, geared forging press with Taper rolls
No. 5—Bliss, double crank, geared forging press press
48" Wickes Bros. double end punch and shear 1¼ thru 1¾ cap. motor drive

We try to maintain one of the leading stocks of Used Machinery.

SEND US YOUR INQUIRIES—EVERY ITEM FULLY GUARANTEED.

FALK MACHINERY COMPANY

MACHINERY MERCHANTS

18 WARD ST., ROCHESTER, N.Y.

REBUILT MACHINERY SAVES VITAL MEN AND METALS

★

PARTIAL LISTING OF ITEMS IN STOCK, SUBJECT TO PRIOR SALE

MILLERS

SPECIAL

2—#3 Brown & Sharpe Vertical, geared head, table 50" x 16½", q.c. feeds

#6 Becker Vertical, belt drive, range 50" x 20" x 20"
#2 Standard, plain, belt drive, table 30" x 8"
(3) Hand Millers, belt drive, table 5" x 20"
#3 Lees Bradner, cap. 3" x 6", mtzd.

GRINDERS

12" x 36" Pratt & Whitney, Vertical Surface, belt drive
12" x 42" Landis, #3 Universal, mtzd.
Sellers Tool Grinder, tub type, motor drive
#6 Bryant Internal, belt drive
18" Gorton Disc Grinder, belt drive

DRILLS

5' Bickford Radial, motor drive, 13" round column
(3) single spindle ball bearing Sensitive Drills

LATHES

42" x 20' H.S. & G. Turning Lathe, belt drive, quick change
36" x 8' South Bend Drum Lathe, belt drive
26"–48" x 16' McCabe double spindle, belt drive
26" x 10' Crawford, mtzd. quick change
20" x 10' National, geared head, quick change
20" x 10' American, belt drive, quick change
20" x 14' Springfield, geared head, quick change
18" x 14' Hamilton, belt drive, quick change
16" x 10' Monarch, belt drive, quick change
14" x 6' Lodge & Shipley, mtzd. quick change

PLANERS, SHAPERS AND SLOTTERS

60" x 60" x 12' L. Pond, 2 heads, belt drive
24" x 24" x 6' Putnam, one head, belt drive
17" x 15" x 3' Machine Tool, one head, belt drive
24" Barker Shaper, back geared, belt drive
21" Smith & Mills Shaper, back geared, belt drive
16" Springfield Shaper, single geared, belt drive
10" Buckton Slotter, belt drive, 24" table

We are representatives in the Philadelphia area for many of the leading national manufacturers of new machinery

THE O'BRIEN MACHINERY CO.

PHILADELPHIA'S LARGEST MACHINERY DEALERS AND EXPORTERS

113 NORTH THIRD STREET • PHILADELPHIA - PENNA.

BELL TELEPHONE: MARKET 4180 CABLE ADDRESS OBRIEN-PHILA

RADIAL DRILL

Bausch 4 ft. plain radial drill, motor drive through gear box, with auxiliary table. Rebuilt and guaranteed.

BORING MILL

Bickford 41 in double housing single head vertical boring mill cone drive.

LATHE

Le Blond 14 x 5 tool room lathe, self contained motor drive, taper attachments, rebuilt and guaranteed.

MILLING MACHINE

Brown & Sharpe No. 0 universal miller in excellent condition.

CARL SMITH

138 Broadway Rensselaer, N. Y.

LATHES

No. 324 Adriance Spinning

MILLING MACHINES

2" Pratt & Whitney spline (duplex) (Double)
No. 1 Foote-Burt Surface Broach
New No. 3 Wigglesworth
No. 2 Knight Vertical
No. 30 Sundstrand Rigid Mill M.D.

TURRET LATHE

Goss & De Leeuw Chucking, 6"x6½".

DRILLS

No. B16 Natco M.D. (2).
No. B13, Natco, M.D.
4 Spindle Taylor & Fenn M.D.
6' Cincinnati Bickford Radial.

GEAR MACHINERY

6 Cimatool chamfering M.D.
No. 4—48" Brown & Sharpe Gear Cutter
Lees Bradner Gear Grinders (2)
9" Pratt & Whitney Gear Grinder

MISCELLANEOUS

8" Bullard Multimatic M.D.
No. 1 Foote-Burt Duplex Surface Broach
21"x21"x5' Whitcomb Planer
24x24x8 Whitcomb Planer
36"x36"x8' Woodward & Powell Planer Rev. M.D.
No. 303 Bliss St. Side Gd. M.D.
2" Acme Belt Threader

WIGGLESWORTH MACHINERY CO.

203 Bent St., Cambridge, Mass.

BRADLEY HAS THE BUYS IN ALL TYPES OF MACHINE TOOLS

DRILLS

4 spdl. Woodward & Rogers
14" Drills

GRINDERS

2—#20 Bryant Internal Grinders
New Combination grinder and polisher
Norton double end grinder
#3 Diamond Surface Grinder
#3 Diamond Surface Grinder
New Bradley hydraulic internal grinders
2—8" Heald Rotary

AUTOMATICS

Model F Gridley 4 spdl. 1¼

LATHES

LeBlond Double End 8"
Perkins 20 x 10' LCG
New American bench lathes

MILLS

Garvin #2 Hand Mill
Porter #500 Vertical
#1 Bristol Hand

PRESSES

Screw Cutting Toledo
6 ton Fox Super Flexible
20 Ton General 18" stroke
#4 Bliss 50 Ton
#94 Bliss
Waterbury Farrell 3" stroke
PG5 Ferracute 70 Ton

SAWS

5' Crescent Swing Saw
36" Wood Band Saw
New Hack saws 6 x 6

PLANERS

Yager Wood 10"

MISCELLANEOUS

Clinch Nut Machine
½ ton electric hoist
#00 Raymond Pulverizer
Feedex table for automatic feedex drill
Hancock Flame Cutting
Waterbury Farrell bolt trimmer
1½" Landis two spdl. threader
#1 LaPointe Broach
3' Radial Drill
24" Rickert Tapper
Williams Pipe threader 6"
Torrington Swedger
Production Polisher
Rickert & Shafer threader
Cross gear tooth rounder
National Acme stud threader

BRADLEY MACHINERY COMPANY

211 Jos Campau Fi. 6375 Detroit, Mich.

1—No. 2 P & W Shaving Machine
1—No. 6 Fellows Gear Shaper
1—Watson-Stillman 4-plunger Horizontal Hydraulic Pump, motor driven

D. E. DONY MACHINERY CO.

New and Used Machine Tools

47 Laurelton Road Rochester, N. Y.

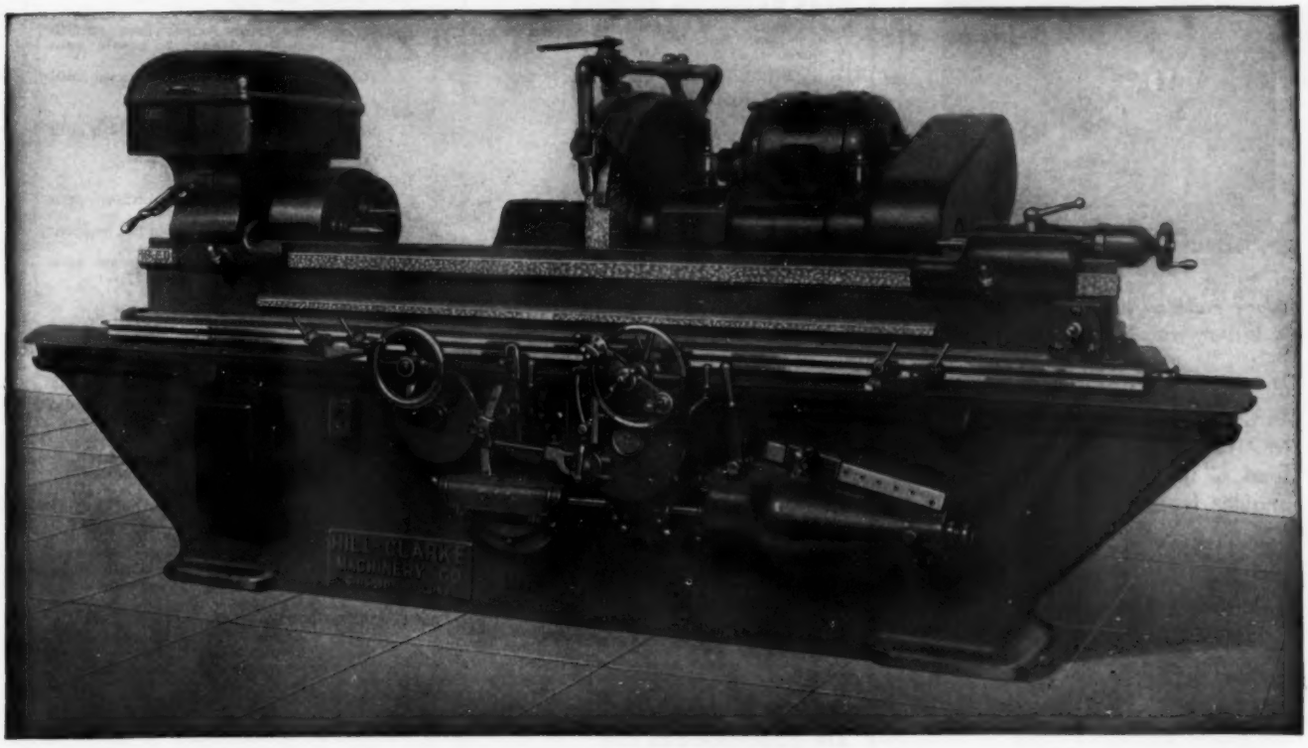
New "SEARCHLIGHT" Advertisements

received by November 30th will appear in the December 10th issue, subject to limitations of space available.

Address copy to the Departmental Staff

American Machinist
330 West 42nd St., New York City

Yours for Super Grinding!



HILL-CLARKE MODERNIZED CYLINDRICAL GRINDERS

give you a finish within a few micro-inches even when using standard grain free-cutting wheels. Contributing to this achievement is a patented multiple V-belt drive from a constant speed motor to the work spindle.

Throughout the machines there are refinements in design, fitting of components, minimized vibration which make possible extreme accuracy in all grinding operations. An accurately fitted wheel slide with cross feed screw mounted in ball bearings provides sensitive wheel control essential to duplicate work within close limits. For complete information, write for our illustrated catalog "Super Grinding."

SIZES			
10 x 36	14 x 36	16 x 50	18-30 x 96
10 x 50	14 x 50	16 x 72	

HILL-CLARKE MACHINERY CO.

651 WASHINGTON BOULEVARD, CHICAGO

KEEP 'EM RUNNING!

Every machine listed in this column is in our warehouse at press time.

60" NEWTON PORTABLE SLOTTER, M.D. with D.C., 230 volt MOTOR and STARTER, 36" cross feed, 6" in and out adjustment and angular feed.

30" HENRY-WRIGHT RADIAL DRILL. Ball Bearing, equipped with rotary tables and box table. Sensitive spindles for 1" cap.

30" BAKER Draw Stroke KEYSEATER Circular table 38" dia. overhang 35".

30" x 30" x 10' NEWTON SLAB MILLER, Horizontal arbor, table working surface 27" x 10', M.D.

14" PUTNAM CRANK SLOTTER, Rotary Table 33" dia. 26" overhang.

400-Ton NILES WHEEL PRESS, Double Type, 48" between bars, equipped with pump and motor.

60" THROAT LONG-ALSTATTER SINGLE END SHEAR, with 20" shear blades, approximate weight 42,000#.

72" LONG-ALSTATTER MULTIPLE PUNCH, 6" throat, 1½" stroke, M.D.

6" x 6" x ⅝" SOUTHWARK DOUBLE ANGLE SHEAR, square or bevel, right or left hand, M.D.

SIMMONS ENGINEERED *Machine Tool* REBUILDING

SIMMONS MACHINE TOOL CORP.
1759 North Broadway, Albany, N. Y.
N. Y. Office: 149 Broadway

EASTERN OFFERS FROM STOCK

GEAR CUTTERS & HOBBERS

Gleason Spiral Bevel Gear Rougher
12" Ingle Gear Tooth Rounder
16" Gould & Eberhardt Gear Cutter
18" Gleason Straight Bevel Gear Generator
18" Gleason Bevel Gear Planer
30" Brainerd Gear Cutter
No. 1-26" Whiton Full Universal Spur & Bevel
No 3-26", 3-36", 3 Heavy, 4-36", 4-48", 6-60", 6-72" Brown & Sharpe Auto. Gear Cutters
No. 615 Fellows Gear Shaper
24" Cross Gear Tooth Rounder
No. 5 Lees-Bradner Gear Generator
No. 12 Barber-Colman Gear Hobber

VALVE SEAT GRINDER

Cincinnati Valve Seat Grinder, centerless type, m.d., with motors, 1934 machine

CYLINDERS GRINDERS

No. 50 Heald, hydraulic (3)
No. 55 Heald, mechanical (3)
No. 60, 65 Heald

CYLINDRICAL GRINDERS

10x36" Landis Integral Cam, m.d.
10x36" Norton Plain, m.d.
10x52" Landis Plain, m.d.
10x72" Norton Plain, m.d.
12x36" Cincinnati Plain, belt
12x36" Modern Plain, m.d.
12"36" Modern Plain, belt
12x42" Landis Plain, belt
12x48" Modern Plain, m.d.
16x120" No. 18 Landis Plain, m.d.
26x96" Landis Plain, m.d.
10x24" No. 2 Universal Grinding Machine Co. Universal, belt

DISC AND EMERY GRINDERS

No. 20 Gardner Comb. Disc and Roll Sander, m.d.
NEW Baldor Emery Grinders, ½ H.P. to 5 H.P. in stock
NEW U. S. Elec. Grinders in stock
Strand Flex. Shaft Grinder, m.d.
No. 516 Mummert & Dixon Radial Grinder, m.d.
No. 1 L. & F. Wet Emery
No. 8 Hanson & Van Winkle, s.p.d.
Mitchell Eng. Co. A1 Polishing Stand, m.d.
Rockford Wet Emery
Springfield Wet Emery, m.d.
5 H.P. Northern Polisher, d.c.

AIR COMPRESSORS

6x6" Curtis Vertical Twin
7x7" Curtis Vertical Twin
Usaco, with tank & motor

ARBOR PRESSES

King Screw, 36" between housings
Barnes Screw, 20" between housings
15 ton Lucas High Pattern Forcing

AUTOMATICS

¾-1½" Cleveland Model B Auto
4 spindle ⅞" Cleveland Model M
No. 6D Potter & Johnston for brake drum work
No. 22, 33 New Britain X

BOLT THREADING MACHINES

3" Landis, gear box, m.d., lead screw
1" Acme 3 spindle
1" Acme 2 spindle
9/16" Landis 2 spindle, gear box
¾" Economy Style R Auto.
1¼" American Bolt Header
No. 118 Rickert-Shafer Auto., m.d., 1" cap.

VERTICAL BORING MILLS

30" Colburn, 1 turret head
42" Niles Car Wheel Borer
48" Niles Car Wheel Borer, facing attach.

HORIZONTAL BORING MILLS

Sargent Floor Type, 2¾" bar
4" Barret double spindle Floor Type, m.d.
5" bar Newark Table Type, m.d.
8" bar Barrett Floor Type, m.d.

BROACHING MACHINES

Cincinnati Mill Broach, m.d., new
No. 2 LaPointe
No. 2 LaPointe of Hudson
No. 3 J. N. LaPointe Double (3)

RADIAL DRILLS

2½' Avey Sensitive
3' American Sensitive
3' Carlton Sensitive
4' Hammond Jack Knife
5' Prentice Plain

Many other machines in stock.

Let us quote on your requirements.

The EASTERN MACHINERY CO.
1004 TENNESSEE AVE.
CINCINNATI, OHIO

. . IN STOCK

AUTOMATICS

¾" Gridley Model F four spindle
No. 52 National Acme, four spindle
2⅛" Cleveland Model A, single spindle
2½" Cleveland Model A, single spindle

BROACHES

No. XB10 Oilgear Hydraulic Twin spindle
15 Ton Hercules Vertical

DRILLS

24" Superior, single spindle, compound table
24" Cincinnati, single spindle, tapping attachment
No. 17 D Moline Hole Hog, six spindle, No. 5 M.T.
4' Prentice Radial
6' Prentice Radial
No. 1½ Foot Burt, 2 spindle
No. 15½ Foote Burt Fixed Center
No. 12 Natco Multiple Spindle
No. 37 Natco Multiple Spindle
No. 1 Bausch, 8 spindle
Pratt & Whitney Gun Barrel, 2 spindle, m.d.

GEAR CUTTERS

No. 3 Brown & Sharpe Automatic
No. 6—72" Brown Sharpe Automatic
No. 6 Fellows Gear
96" Gleason Gear Planer
15" Gleason Spiral Bevel Generator
18" Gleason Gear Tester
No. 5A Lees-Bradner Gear Generator
No. 10 Lees-Bradner Gear Grinder
30" Rochester Gear Tooth Rounder

GRINDERS

10" x 24" Landis Universal
No. 2 Webster & Perks Universal
No. 2 Cincinnati Centerless
10" x 20" Landis Cylindrical hydraulic
No. 60 Heald Cylinder
No. 24—53" Gardner Disc

LATHES

14" x 8' Walcott, c.d.
16" x 6' Cisco, q.h.
16" x 6' LeBlonde, c.d.
17" x 8' Sidney, c.d.
24" x 12' Whitcomb Blaisdel, c.d.
24" x 12' Walcott, c.d.
24" x 14' Reed Prentice, q.h.
30" x 13' American, q.h.

TURRET LATHES

24" Steinle, q.h. 6" hole
No. 6A Potter & Johnston, q.h.

MILLS

No. 1 Kempsmith Universal, c.d.
No. 1½ Cincinnati Universal, c.d.
No. 1404 K&T Duplex Milwaukee Mill, m.d.
No. 31 DeVlieg Super Mill, m.d.
No. 12 Brown & Sharpe Plain, c.d.
No. 4 Cincinnati Vertical, s.p.d.
2½ Cleveland Horizontal Boring, s.p.d.
4" Bement-Niles Horizontal Boring
42" Niles Vertical Boring
4½" x 12" Pratt & Whitney Thread Mill
6" x 48" Pratt & Whitney Thread Mill

MISCELLANEOUS

Wicaco Oil Groover
2" Pratt & Whitney Duplex Spline Mill
No. 253 Dreis & Krump Press Brake, m.d.
2½" Landis Bolt Cutter, with lead screw
No. 8 Whitney Comb. Punch & Shear

PLANERS AND SHAPERS

33" x 38" x 12' Niles Double End Planer, 4 heads
16" Gould & Eberhardt Shaper, c.d.

SAWS

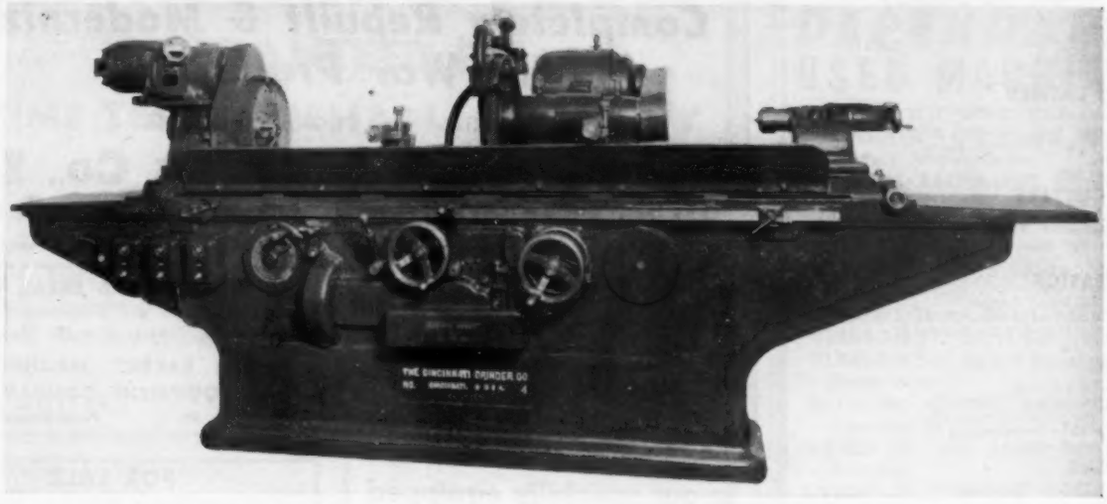
6" x 6" Peerless Universal Shaping, m.d.
9" x 9" Peerless Universal Shaping, m.d.
No. 12 Higley Cold Cut, 16" blade
48" Ryerson Friction, m.d.

TAPPERS

½" Rickert Shafer Radial, m.d.

INDIANAPOLIS MACHINERY & SUPPLY CO., INC.
1959-69 South Meridian Street
INDIANAPOLIS, INDIANA
Eastern Branch:
44 WHITEHALL STREET, NEW YORK, N. Y.

RE-BUILT



#4, 12" x 72" Cincinnati Plain Cylindrical Grinder rebuilt and motorized.
Four motors including Master Speed Ranger.
Speeds infinitely variable from 50 to 150 r.p.m.
The illustration is exactly the machine we are offering for *immediate shipment*

Complete specifications on request

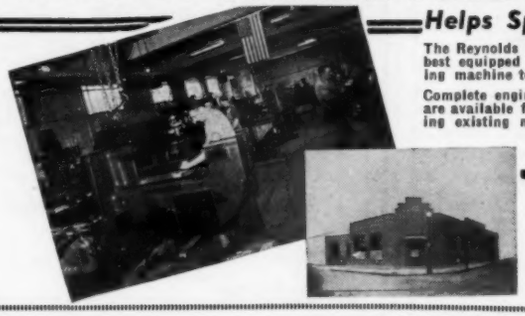
All motors 220 volt, 3 phase, 60 cycle

FRANK TOOMEY MACHINERY COMPANY

116 N. 3rd St. *Walnut 5575* **PHILADELPHIA, PA.**

REYNOLDS MACHINE TOOL REBUILDING . . .

Helps Speed War Production



The Reynolds plant is one of the most modern and best equipped plants in Rhode Island for rebuilding machine tools.

Complete engineering and manufacturing facilities are available for modernizing, motorizing and placing existing machine tools in condition for maximum production demands and highest accuracy.

REYNOLDS MACH'Y CO.
211 Eddy St.
PROVIDENCE, R. I.
Phone: Gaspee 5187

ST. LOUIS' Headquarters FOR GOOD USED TOOLS, OFFERS:

ROCKFORD 24" S.P.D. Shaper
COLBURN 42" Vert. Boring Mill
MUELLER 4½' Gear Box Drive Radial Drill
PUTNAM 27"x14' Q.C.G. Lathe
PRENTICE 24"x12' M.D. Grd. H.D. Lathe
GISHOLT 30" Vert. Turret Lathe.
OHIO #20 Plain Miller
NILES 12" Vert. Slotter
INGERSOLL 2—SP. Vert. Miller
B&S 48"x10". #4 Gear Cutter
DIAMOND M. D. Horiz. Surf Grinder
GOULD & EBERHARDT Rotary Milling Mach.
BIGNALL-KEELER 12" M.D. Pipe Machine.

Write Us For Any Other Tools You May Want
Let Us Quote On All Machinery Needs

McDONALD MACHINERY CO.
1531-35 N. Broadway St. Louis, Mo.

AUTOMATICS, 6" x 6¾" Goss & De Leeuw, #34 New Britain Chucker

BOLT AND PIPE THREADERS—1½" Landis Dble. Hd. Bolt; 1½" & 3" National; 10" & 6" Saunders Pipe.

BORING MILLS—84" N.B.P. 2 hds., M.D.; 42" Bullard New Era Type.

GRINDERS— 30" x 240" Landis Cyl.; 24" x 96" Landis Cyl.; 20" x 96" Landis Cyl.; 12" x 96" Landis; 12" x 120" Landis; 14" x 96" Cincinnati; 24" Bridgeport Disc D.C., M.D.

GEAR CUTTERS—11" & 6" Gleason Bevel Gear Generators (4); 36" G & E Spur and Bevel. 48" & 36" Cinci spur (2), 60" Gould & Eberhardt, spur.

KEYSEATERS—#3 Baker, 26" stroke x 3" wide; #6 Catlin 40" stroke x 5" wide; #4 Mitts & M.

MILLING MACHINES—#3 Lees Bradner Thread Miller; #6 Jackson Die Sinker or Vertical Miller

PLANERS & SHAPERS—36" x 36" x 10' Flather, 2 hds., M.D.; 26" x 8' Gray; 16" Gould & Eberhardt.

RADIAL DRILLS—6' & 5' N.B.P. Plain.

LATHES—21" x 14' LeBlond; 24" x 14' Schumacher Boye, T.A.; 26"x16' Putnam, T.A.; 48" x 26' New Haven; 64" x 28' New Haven.

TURRET LATHES—#3A Warner & Swasey, 4¾" hollow spindle, bar and chucking.

ROSENKRANZ MACHINERY Co.
30 Church Street New York, N. Y.

OTT MACHINERY SPECIALS

AUTOMATICS, Cleveland, 1-1/16", Model A
AUTOMATICS, Gridley, 2¼, 3¼ & 4¼" S.S.
AUTOMATICS, Cleveland ⅞ & 2½" Model B
AUTOMATICS, Cleveland ¾" Model M, 4 spdle.
AUTOMATICS, #22, 23 & 24 New Britain
GRINDERS, Norton, 10 & 14x36" Plain

60" x 17' Putnam Lathe with 12" Riser Blocks, total swing 85" M.D.

LATHE, 3x36" J.&L. Dble. Spdle.
MILLING MACHINES, Craftsman #1, 2 & 3
PLANERS, Bedford & Patch, 36"x13' Open Side with 1 Rail & 1 Side Head
PRESSES, Toledo, #34 Solid Back, S.G.
PRESSES, Toledo #2 to 5 Open Back Inclinable
PRESSES, Ferracute, P2, 3 & 4, Solid Back

OTT MACHINERY SALES, INC.
542 Second Ave. Detroit, Mich.

AVAILABLE NOW

14"—18"—20" Inserted Tooth Face Mills; good condition

24x24x6' Cincinnati heavy-duty Planer; motor drive; excellent condition

Table-type Boring Mill 2½" bar

No. 2 two-spindle LaPointe Broach

Van Norman Radial Grinders

Pratt & Whitney Profiler; 19" between housings.

A. R. MARSH MACHINERY CO.
4900 W. 73rd St. Cleveland, Ohio

LATHE

1—18" Hamilton cone drive lathe, 4 feet between centers; standard gear; good condition, with a good assortment of necessary tools.

JAS. C. McCLELLAN
1008 Nutwood Ave. Bowling Green, Ky.

MODERN TOOLS

Immediate Delivery

LATHES
LeBlond—21" x 10' G.H. Crankshaft
Hendy—12" x 5'
Porter Cable

TURRET LATHES
Jones & Lamson—3 x 36" M.D.
Gisholt—21"—2" through spindle
Gisholt—5¾" through spindle
Garvin—1"
Garvin—1¼"

GEAR CUTTERS
26" Brown & Sharpe
36" Fellows
G.E. 3 x 36" Spur
G.E. 36"

AUTOMATICS
1—#53 National Acme
5—#55 National Acme, M.D.
1—2¼" Gridley Single Spindle
1—B & S 2G

MILLERS
#3 Garvin Duplex
3—18" Cincinnati Production
1—12" Cincinnati Production
5—7H Becker Production
1—#3 Van Norman

GRINDERS
Modern—16" x 60" M.D.

SHAPERS
G & E 24" M.D.
G & E 16" M.D.

RADIAL DRILLS
4' Bickford
Foote Burt Heavy Duty Drill

BORING MILLS—HORIZONTAL
4" Single Pulley Driven Bickford
2" Binsee

MISCELLANEOUS
American Planer 36" x 36" x 8'. 2 Heads on rail M.D.
10' Geo. A. Ohl Power Shear 14 Gauge
36" Throat Heavy Duty Punch, M.D.
1000 Lb. Chambersburg Steam or Air Hammer, Single Frame
10" & 12" Slotters—Newton
16" Beasley Ball Bearing Grinder
3—Form Rolling Machines (5 sets of Form Rollers)
1—Heller Motor Driven Cold Saw with 24" Blades and 1 Machine to grind Saws for same.
Thompson Spot Welder—50 KVA Air operated.

This is only a partial list
What do you need?
Contact us for rebuilt machinery

S. & S. MACHINERY CO.
207 CENTRE STREET
NEW YORK, N. Y.
WOrth 4-5710

Your Old Machine Tools
Completely Rebuilt & Modernized for War Production

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RIVERSIDE MACHINERY Co., Inc.
133 MULBERRY ST. (WOrth 4-5711) NEW YORK CITY

Have your

used MACHINE TOOLS thoroughly REBUILT

in our *specially equipped* 14,000 sq. ft. factory

Precision work
Prompt delivery
Free estimates

EAST RIVER MACHINERY CORP.
432 Bryant Ave., Bronx, N. Y.
Tel: DAyton 3-4246

City office: **1501 Broadway, New York**
Tel: PEnnsylvania 6-4430

Now available for sale:

42" COLBURN Boring Mill
36"x36"x12' WOODWARD & POWELL Planer
16"x12' SIDNEY Lathe, g.h.
18"x8' SOUTH BEND Lathe
22"x10' HAMILTON geared head lathe
30"x22 FAY & SCOTT Lathe
#1 BECKER Vertical Miller
#25 BECKER Plain Milling Machine
#4 PEDRICK & AYRES Universal Milling Machine
16" STEPTOE Shaper
#2 O.S. WALKER Universal Tool & Cutter Grinder
 # MODERN Universal Cylindrical Grinder (2)
#2 BATH 10"x25" Universal Grinder
23x52 LANDIS Plain Cylindrical Grinder
14" PRATT & WHITNEY Vertical Surface Grinder, ball bearing
2L GISHOLT Turret Lathe, g.h.
3x36 JONES & LAMSON Turret Lathe, g.h.
#515 NATIONAL ACME 4 spindle Automatic
4' PRENTICE Radial Drill
5' CINCINNATI Radial Drill
36" PUTNAM Heavy duty Drill Press
24" NILES B.P. Drill Press
#21 BLISS Power Press, 1¾" stroke
#0 BLISS Power Press

PLANERS

24"x24"x6' Flather, 1 head.	35¼"x42¼"x10' Davis, 2 hds.
24"x24"x6' Whitcomb, 2 hds.	30"x30"x8' Gray, 1 hd.
32"x32"x10' Pond, 1 hd.	36"x36"x12' Niles, 1 hd.

CANAL MACHINERY COMPANY
176 LAFAYETTE STREET, NEW YORK, N.Y.

RECONDITIONED BREAD PANS
Strapped 4 to set. Excellent for small parts and production work. Sample free.
EFFRON BAKERS' MACHINERY & EQUIPMENT COMPANY
136 Smith St. Poughkeepsie, N. Y.

FOR SALE
Landis and J. & L. High Speed Die Head Chasers
300 sets
Write for list.
CARL A. YARD
Sea Girt, N. J.

IF there is anything you want . . .

that other readers of this paper can supply

or—
something you don't want

that other readers can use, advertise it in the

SEARCHLIGHT SECTION

RECENTLY ADDED TO OUR STOCK

Niles Vertical Miller No. 10, with rotary table 42" diameter.

Niles Bement Pond Planer, 36" x 36" x 10', 3 heads, direct motor driven with motor 7½ H.P.

Pratt & Whitney Turret Lathe 2½", geared head, with thread cutting attachment.

Monarch Turret Lathe, 14" x 6', hole in spindle 1½", motorized.

Steinlee Turret Lathe, geared head, 6½" hole in spindle.

Bement Vertical Slotter, heavy duty, 20" stroke arranged for motor drive.

UNIT MACHINE TOOL CO.
123 Lafayette St. New York, N. Y.
Telephone: Canal 6-3890

USED MACHINE TOOLS
GUARANTEED BY
A TIME TESTED, RELIABLE COMPANY

DRILLS
- 1 spdl. Leland-Gifford
- 2 spdl. Leland-Gifford Bench
- 4 spdl. Henry & Wright
- 4 spdl. Sigourney
- 4 spdl. Woodward & Rogers

GEAR CUTTERS
- No. 60 BM Gould & Eberhardt Bevel Gear Rougher (2)

GRINDERS
- (See page 179—special advertisement Hill-Clarke Cylindrical Grinders)
- No. 40 Bryant Plunge Cut, Wide Wheel, Oscillating
- No. 10 Lees-Bradner Spur Gear Grinder
- 1½" dia. New Yankee Drill Grinder

LATHES
- No. 4 AC LeBlond Auto. Duplex Crankshaft

TAPPERS
- No. 4 Gaterman Tapper, 5/16" Capacity

HILL-CLARKE MACHINERY CO.
651 W. WASHINGTON BLVD. CHICAGO

Announcing Our New Location

6—Gleason Gear Cutters, 11" and 18" machines
52x20' New Haven Lathe
48" Boring Mill
12—25 KVA Spot Welders
48x8 Planer
500# Board Drop Hammer
1000# Steam Hammer
Cleveland Automatics—⅞", 2¼", 2¾", single spindle
Arter Grinder, 6x20, cylindrical

Paul's Motor & Machinery Supply Company
6111 Vermont St. Detroit, Michigan
Tyler 76300-02

MISCELLANEOUS MACHINES

Rockford Sgl. End Hydr. Boring Machine with 2-sta. 54" dia. table.
6' Niles Pl. Radial Drill
No. 60 NATCO 3-Way Multiple Drill
4-Spdl. Henry & Wright H.S. Drill
Niagara Dbl. Seamer, t.&l. pulley dr.
10x10" Napier Metal Band Saw
½" Shuster Auto. Cut.&Straight. Machine

STRONG, CARLISLE & HAMMOND COMPANY
1392 West 3d St., Cleveland, Ohio
2832 E. Grand Blvd., Detroit, Mich.

IF YOU ARE DOING DEFENSE WORK

Send for Our Latest Circular Covering Bargains in Small Tools Such as Drills, Reamers, Turret Attachments, etc.

DeWITT TOOL COMPANY
173 Grand St. New York City

UNUSUAL VALUES

12"x6' Seneca Falls lathe, loose change gear
3¼" x 50" Fitchburg Lo-swing Lathe.
Turret, Lodge & Davis, Brass cross slide turret.
Brake: Robinson toggle 5'
Drill Presses: 28", 24" Hoefer; 25", 20", 40" Bement
Ceiling Suspended Drill Unlimited drilling area
Grinders: #20 Bryant Internal
60" Plate grinders.
#60 Heald cylinder grinders.
Sellers Tool Grinder
300 other machinery items
Rock River ⅞" capacity punch and shear
1—3-spindle 1" capacity Bolt Cutter.
1—2-spindle #0 Webster & Perks Threader.
Bolt Cutter 1¾ Acme with Landis Head.
Vacuum Cleaner, Invincible, shop size.
2—½" capacity Punch and Shears.
MOTORS—new 5 H.P. for 3-phase, ball brg. Also rebuilt motors.

THE OSBORNE & SEXTON MACHINERY CO.
COLUMBUS, OHIO

FOR SALE
No. 8 AJAX BULLDOZER
with direct motor drive 20 H.P. A.C. and Starter

IRON & STEEL PRODUCTS, INC.
13498 S. Brainard Ave. Chicago, Illinois
37 years' experience
"Anything containing IRON or STEEL"

500# B&S Board Drop Hammer.
800# B & S Board Drop Hammer.
#14 Cochrane-Bly Vert. Miller & Shaper, M.D.
50" G & E Gear Cutter.
4' Bickford Radial Drill.
#55 Heald Internal Grinder.
10' Bridgeport Knife Grinder.
20"-24" G & E Shapers.
36" Morton Draw Cut Shaper.
No. 2 Baker Keyseater, 2"x20".

WEST PENN MACHINERY COMPANY
1210 House Bldg. Pittsburgh, Pa.

MOREY
DEPENDABLE
USED MACHINES

La POINTE No. 2 Double Spindle Broach Motor Drive
GOULD & EBERHARDT 48" Gear Cutter
GOULD & EBERHARDT 36B Spur & Bevel Gear Cutter
WHITON No. 15 Auto. Gear Cutter
FELLOWS No. 6 Gear Shaper
GLEASON 37" Bevel Gear Planer
GLEASON 10" Spiral Bevel Gear Generator
GLEASON 6"-18" Bevel Gear Generators
HEALD No. 70A Duplex Internal Grinder
LANDIS 3½" Internal Hydraulic Race Grinder
NORTON 16"x50" Crankshaft Grinder—M.D.
HEALD No. 60 Internal Grinder
INGERSOLL 24" Cutter Grinder
GARDNER No. 6 Dble. End BB Disc Grinder
PRATT & WHITNEY 6" x 132" Thread Miller
AUTOMATIC MACHINE CO. 12"x4' Automatic Relieving Type Lathe
BRIDGEFORD 27" x 10' Boring Lathe

BICKFORD
5' Vertical Boring Mill
2 Swivel Heads Motor Drive

P. & W. No. 12 Multi-Spindle Drill
NATCO C-13 Hyd. Multiple Spindle Drill
NATCO C-11C Multiple Spindle Drill
ESPEN LUCAS No. 138 Cold Saw —Cap. 12" Rd.
NEWTON No. 197 & No. 200 Cold Saws
COCHRANE & BLY No. 5 Cold Saw
COULTER 2 Spindle Diamond Borer—M.D.
LANDIS 4" Single Head Bolt Threader
ACME 1" All Steel Upsetter
AJAX 3" All Steel Upsetter
SAUNDERS 8"-18" Pipe Threader
TREADWELL 12" Pipe Machine
GISHOLT Precision Balancing Machine
LONG & ALSTATTER Double Angle Shears

THIS IS A PARTIAL LIST

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your Specific Inquiries

MOREY
MACHINERY CO., Inc.
410 BROOME ST., NEW YORK

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Warner & Swasey Co., Cleveland

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Colonial Broach Co., Detroit

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Detroit Universal Duplicator Co., Detroit
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Gisholt Machine Co., Madison, Wis.
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Sundstrand Mach. Tool Co., Rockford, Ill.
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Waterbury Steel Ball Co., Poughkeepsie, N. Y.

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Johnson Bronze Co., New Castle, Pa.

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Dodge Mfg. Corp., Mishawaka, Ind.

BEARINGS, Ball
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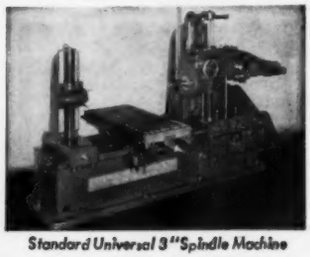

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Bryant Machinery & Engrg. Co., Chicago
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National Broach & Machine Co., Detroit
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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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Johnson Bronze Co., New Castle, Pa.
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Rivett Lathe & Grinder, Inc., Boston
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Tomkins-Johnson Co., Jackson, Mich.
Warner & Swasey Co., Cleveland

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Cleveland Automatic Mach. Co., Cleveland
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Hendley Machine Co., Torrington, Conn.
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Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
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Brown Instrument Co., Philadelphia

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Chisholm-Moore Hoist Corp., Tonawanda, N. Y.
Cleveland Crane & Engrg. Co., Wickliffe, O.
Curtis Pneumatic Machy. Co., St. Louis
Harnischfeger Corp., Milwaukee
Wright Mfg. Div., American Chain & Cable Co., Inc., York, Pa.

CUSHIONS, Die
V. & O. Press Co., Hudson, N. Y.

CUTTERS, Angle
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
C. & W. Tool Co., Cambridge, Mass.
Carboloy Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
McCrosky Tool Co., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago

CUTTERS, Die-Sinking
C. & W. Tool Co., Cambridge, Mass.
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Gorton Machine Co., Geo., Racine, Wis.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.

CUTTERS, Formed
Atkins & Co., E. C., Indianapolis
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
C. & W. Tool Co., Cambridge, Mass.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Weldon Tool Co., Cleveland

CUTTERS, Gear
Adams Co., Dubuque, Iowa
Bantam Bearings Corp., S. Bend, Ind.
Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
C. & W. Tool Co., Cambridge, Mass.
Cleveland Hobbing Mach. Co., Cleveland
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Scherr Co., Geo., N. Y. C.
Standard Tool Co., Cleveland
Stow Mfg. Co., Binghamton, N. Y.
Taylor Machine Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Waltham Mach. Wks., Waltham, Mass.

CUTTERS, Hand Pipe (See **STOCKS, DIES & CUTTERS, Pipe**)

CUTTERS, Keyseater
Baker Bros., Inc., Toledo, O.
Barber-Colman Co., Rockford Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Colonial Broach Co., Detroit
Davis Keyseater Co., Rochester, N. Y.
Ex-Cell-O Corp., Detroit
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Mitts & Merrill, Saginaw, Mich.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
National Machine Tool Co., Cincinnati
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.

CUTTERS, Milling
Atlas Press Co., Kalamazoo, Mich.
Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
C. & W. Tool Co., Cambridge, Mass.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Disston & Sons, Inc., Henry, Philadelphia
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gorton Mach. Co., George, Racine, Wis.
Grayson Mfg. Co., Monrovia, Calif.
Haynes Stellite Co., N. Y. C.
Illinois Tool Works, Chicago
Kearney & Trecker Corp., Milwaukee
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., Meadville, Pa.
McKenna Metals Co., Latrobe, Pa.
Michigan Tool Co., Detroit

WHERE-TO-BUY DIRECTORY

Modern Tool Works, Rochester, N. Y.
Morse Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
O K. Tool Co., Shelton, Conn.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Waltham Mach. Wks., Waltham, Mass.
Weldon Tool Co., Cleveland
Wendt Sonis Co., Hannibal, Mo.
Williams & Co., J. H. Buffalo, N. Y.

CUTTING-OFF MACHINES (See SAWS)

CUTTING-OFF MACHINES, Abrasive-Wheel
Bridgeport Safety Emery Wheel Co., Bridgeport, Conn.
Campbell Div., Andrew C., American Chain & Cable Co., Bridgeport, Conn.
deSanno & Sons, Inc., A. P., Philadelphia
Porter McLeod Machine Tool Co., Inc., Hatfield, Mass.
Racine Tool & Mach. Co., Racine, Wis.

CYLINDERS, Air (See TANKS & CYLINDERS, Air)

CYLINDERS, Hydraulic (See PRESSES, Hydraulic)

DEALERS, Machinery (See Searchlight Section)

DEGREASERS (See Metal Cleaning Equipment)

DEMAGNETIZERS
Abrasive Machine Tool Co., E. Providence, R. I.
Bickford Mach. Co., Cambridge, Mass.
Lehr Chuck Co., Toledo, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

DIAMONDS, Industrial
Carboloy Co. Inc., Detroit
Crafts Co. Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Tool Co., Chicago
Smit & Sons, Inc., J. K., N. Y. C.

DIE-CASTING MACHINES
Continental Machines, Inc., Minneapolis
Reed-Prentice Corp., Worcester, Mass.

DIE-HEADS, Threading
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Chaso Tool Co., Royal Oak, Mich.
Eastern Machine Screw Corp., New Haven, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap and Die Corp., Greenfield, Mass.
Hill Acme Co., Cleveland
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Warner & Swasey Co., Cleveland

DIE-MAKERS' SUPPLIES
Baumbach Mfg. Co., E. A., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Co., Inc., Detroit
Danly Mach. Specialties, Inc., Chicago
Dykem Co., St. Louis
Lufkin Rule Co., Saginaw, Mich.
Producto Mach. Co., Bridgeport, Conn
Starrett Co., L. S., Athol, Mass.

DIE-MAKING & CUTTING MACHINES
Cincinnati Milling Mach. Co., Cincinnati
Continental Machines, Inc., Minneapolis
Gorton Machine Co., Geo., Racine, Wis.
Henry & Wright Mfg. Co., Hartford, Conn.
Illinois Tool Works, Chicago
Johnson Tool Co., E. Providence, R. I.
Peerless Machine Co., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.

DIE-SETS
Baumbach Mfg. Co., E. A., Chicago
Card Mfg. Co., S. W., Mansfield, Mass.
Danly Mach. Specialties, Inc., Chicago
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DIE-SINKING MACHINES
Cincinnati Milling Mach. Co., Cincinnati
Gorton Machine Co., Geo., Racine, Wis.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.

DIES, Marking & Embossing
Acromark Co., Elizabeth, N. J.
Cunningham Co., M. E., Pittsburgh
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., East Hartford, Conn.

DIES, Screw-Cutting, Adjustable
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Eastern Machine Screw Corp., New Haven, Conn.
Errington Mech. Lab., Stapleton, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mach. Co., Springfield Vt.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Works, Rochester, N. Y.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit
National Acme Co., Cleveland
Rickert-Shafer Co., Erie, Pa.
Standard Tool Co., Cleveland
Threadwell Tap & Die Co., Greenfield, Mass.

DIES, Sheet-Metal & Forging
Hamilton Tool Co., Hamilton, O.
Scully-Jones & Co., Chicago
Taft-Peirce Mfg. Co., Woonsocket, R. I.

DIES, Solid Bolt & Pipe
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Consolidated Machine Tool Corp., Rochester, N. Y.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Oster Mfg. Co., Cleveland
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Rickert-Shafer Co., Erie, Pa.
Warner & Swasey Co., Cleveland

DIES, Sub-Press
Baumbach Mfg. Co., E. A., Chicago
Danly Mach. Specialties, Inc., Chicago
Producto Machine Co., Bridgeport, Conn.
V & O Press Co., Hudson, N. Y.
Waltham Mach. Works, Waltham, Mass.

DIES, Wire-Drawing & Extrusion
Carboloy Co., Inc., Detroit
Crafts Co., Arthur A., Boston
Firth-Sterling Steel Co., McKeesport, Pa.
Illinois Tool Works, Chicago
Metal Carbides Corp., Youngstown, O.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vascoloy-Ramet Corp., N. Chicago, Ill.

DISKS, Abrasive (See WHEELS, Grinding & Polishing)

DISKS, Circular Cutting
Atkins & Co., E. C., Indianapolis
Disston & Sons, Inc., Henry, Philadelphia
Morse Twist Drill and Machine Co., New Bedford, Mass.

DIVIDERS (See CALIPERS & COMPASSES)

DOGS, Lathe & Milling-Machine
Armstrong Bros. Tool Co., Chicago
Atlas Press Co., Kalamazoo, Mich.
Cincinnati Lathe & Tool Co., Cincinnati
Hendey Machine Co., Torrington, Conn.
LeBlond Mach. Tool Co., R. K., Cincinnati
Ready Tool Co., Bridgeport, Conn.

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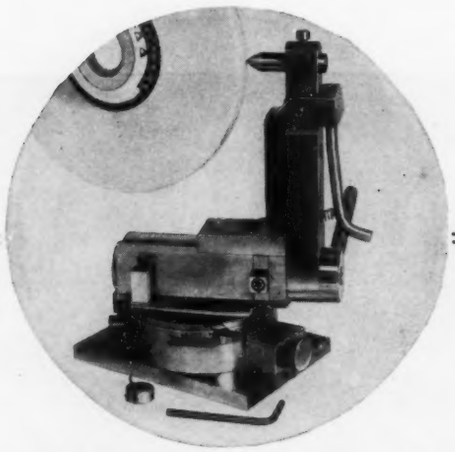

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Sturdimatic Tool Co., Detroit
Williams & Co., J. H., Buffalo, N. Y.

DRESSERS, Grinding Wheel
American Swiss File & Tool Co., Elizabeth, N. J.
Atkins & Co., E. C., Indianapolis
Black & Decker Mfg. Co., Towson, Md.
Carboloy Co., Inc., Detroit
Carborundum Co., Niagara Falls, N. Y.
Chicago Wheel & Mfg. Co., Chicago
Crafts Co., Inc., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana, O.
Disston & Sons, Inc., Henry, Philadelphia
Dumore Co., Racine, Wis.
Metal Carbides Corp., Youngstown, O.
Smit & Sons, J. K., N. Y. C.
Standard Tool Co., Cleveland
Victor Machinery Exchange, N. Y. C.

DRESSERS, Radius & Angle
Auto Ordnance Corp., Bridgeport, Conn.
J & S Tool Co., E. Orange, N. J.
Norton Co., Worcester, Mass.
Schultz & Anderson Co., Newark, N. J.

DRESSING, Belt
Houghton & Co., E. F., Philadelphia
Tide Water Associated Oil Co., N. Y. C.
White & Bagley, Worcester, Mass.

DRIERS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

DRIFTS, Drill
Armstrong Bros. Tool Co., Chicago
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford, Mass.
Standard Tool Co., Cleveland

DRILLROD, Steel Tool (See **STEEL, Tool**)

DRILLS, Automatic & Semi-Automatic
Avey Drilling Machine Co., Cincinnati
Baker Bros., Inc., Toledo, O.
Barnes Co., W. F., & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Cross Gear and Machine Co., Detroit
Davis & Thompson Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.

DRILLS, Bench
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
North Bros. Mfg. Co., Philadelphia
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Ryerson & Son, Jos. T., Chicago
Schauer Mach. Co., Cincinnati
Skilsaw, Inc., Chicago
Walker-Turner Co., Plainfield, N. J.

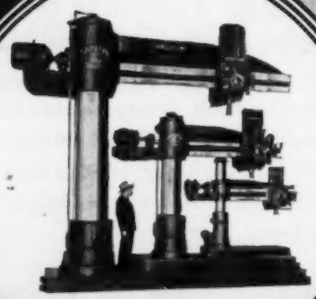
DRILLS, Breast (See **TOOLS, Hand**)

DRILLS, Center
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill and Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Co., Div. Niles-Bement-Pond Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.

DRILLS, Column-Type
Atlas Press Co., Kalamazoo, Mich.
Baker Bros., Inc., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Dalzen Tool & Mfg. Co., Detroit
Davis & Thompson Co., Milwaukee
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., Detroit

DRILLS, Core
Carboloy Co., Inc., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Haynes Stellite Co., N. Y. C.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Wendt Sonis Co., Hannibal, Mo.

DRILLS, Flat (See **DRILLS, Twist & Flat**)



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DRILLS, Hand (See TOOLS, Hand)

DRILLS, Horizontal
Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, Ohio.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bradford Machine Tool Co., Cincinnati
Buhr Mach. Tool Co., Ann Arbor, Mich.
Cincinnati Gilbert Machine Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Giddings & Lewis Mach. Tool Co., Fond du Lac, Wis.
Kingsbury Mach. Tool Co., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
Murchey Machine and Tool Co., Detroit
National Auto. Tool Co., Richmond, Ind.
Ryerson & Son, Jos. T., Chicago
Sellers & Co., Inc., Wm., Philadelphia
Snyder Tool & Engrg. Co., Detroit
Universal Boring Mach. Co., Hudson, Mass.

DRILLS, Deep-Hole
Barnes Co., W. F. & John, Rockford, Ill.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.

DRILLS, Multi-Spindle or Gang
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Baker Bros. Inc., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes Drill Co., Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass
Bodine Corp., Bridgeport, Conn.
Bradford Machine Tool Co., Cincinnati
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Bullard Co., Bridgeport, Conn.
Cincinnati Bickford Tool Co., Cincinnati
Consolidated Machine Tool Corp., Rochester, N. Y
Davis & Thompson Co., Milwaukee
Delta Mfg. Co., Milwaukee
Ex-Cell-O Corp., Detroit
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Grant Mfg. & Mach. Co., Bridgeport Conn.
Greenlee Bros. & Co., Rockford, Ill.
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Kingsbury Mach. Tool Co., Keene, N. H
Leland-Gifford Co., Worcester, Mass.
Moline Tool Co., Moline, Ill.
National Auto. Tool Co., Richmond, Ind
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Snyder Tool & Engrg. Co., Detroit

DRILLS, Portable Electric (See TOOLS, Portable Electric)

DRILLS, Portable Pneumatic (See TOOLS, Portable Pneumatic)

DRILLS, Radial
American Tool Works Co., Cincinnati
Bryant Machinery & Engrg. Co., Chicago
Carlton Machine Tool Co., Cincinnati
Cincinnati Bickford Tool Co., Cincinnati
Cincinnati Gilbert Mach. Tool Co., Cincinnati
Cleveland Punch & Shear Works, Inc., Cleveland
Fosdick Machine Tool Co., Cincinnati
General Machy. Corp., Hamilton, O.
Leland-Gifford Co., Worcester, Mass.
Morris Machine Tool Co., Cincinnati

DRILLS, Sensitive
Atlas Press Co., Kalamazoo, Mich.
Avey Drilling Machine Co., Cincinnati
Barnes Co., W. F. & John, Rockford, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Buhr Mach. Tool Co., Ann Arbor, Mich.
Dalzen Tool & Mfg. Co., Detroit
Delta Mfg. Co., Milwaukee
Dumore Co., Racine, Wis.
Foote-Burt Co., Cleveland
Fosdick Machine Tool Co., Cincinnati
Hamilton Tool Co., Hamilton, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Kingsbury Mach. Tool Corp., Keene, N. H.
Leland-Gifford Co., Worcester, Mass.
National Auto. Tool Co., Richmond, Ind.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
Scherr Co., Geo., N. Y. C.
Walker-Turner Co., Inc., Plainfield, N. J.

DRILLS, Twist & Flat
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Union Twist Drill Co., Athol, Mass.
Victor Machinery Exchange, N. Y. C.
Whitman & Barnes, Detroit

DRIVES, Machine
Cincinnati Lathe & Tool Co., Cincinnati
Dayton Rubber Mfg. Co., Dayton, O.
Drive-All Mfg. Co., Detroit
General Electric Co., Schenectady, N. Y.
Hardinge Brothers, Inc., Elmira, N. Y.
Reed-Prentice Co., Worcester, Mass.
Reliance Elec. & Engrg. Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Sheldon Mach. Co., Chicago
Turner Machinery Co., Kansas City, Mo.

DRIVES, Variable-Speed (See TRANSMISSIONS, Variable-Speed)

DRIVES, "V"-Belt
Allis-Chalmers Mfg. Co., Milwaukee
American Pulley Co., Philadelphia
Dayton Rubber Mfg. Co., Dayton, O.
Gates Rubber Co., Denver, Colo.

DRIVES, Worm
Adams Company, Dubuque, Iowa
Bilgram Gear & Mach. Wks., Philadelphia
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Earle Gear & Mach. Co., Philadelphia
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
Grant Gear Works, Boston
Michigan Tool Co., Detroit
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia

DRYING Machines (See MACHINES, Washing and Drying)

DUPLICATORS, Pantograph
Detroit Universal Duplicator Co., Detroit
Turchon Follower Machine Co., Detroit

ELECTRICAL EQUIPMENT (see also MOTORS, Electric; CONTROLLERS, Motor; SWITCHES
Allen-Bradley Co., Milwaukee
General Electric Co., Schenectady, N. Y.
Square D. Co., Milwaukee
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

ELECTRODES, Welding
Air Reduction, N. Y. C.
Aluminum Co. of America, Pittsburgh
American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland
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McKay Co., Pittsburgh, Pa.
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Gorton Machine Co., Geo., Racine, Wis
Reed-Prentice Co., Worcester, Mass.

ETCHERS, Electric
Gorton Machine Co., Geo., Racine, Wis.

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EXTRACTORS, Screw
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Greenfield Tap & Die Corp., Greenfield, Mass.
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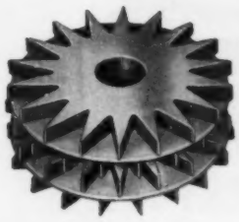

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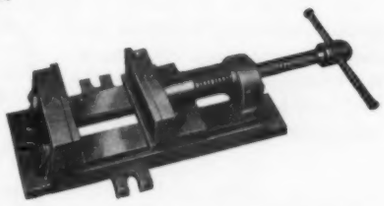

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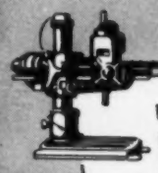

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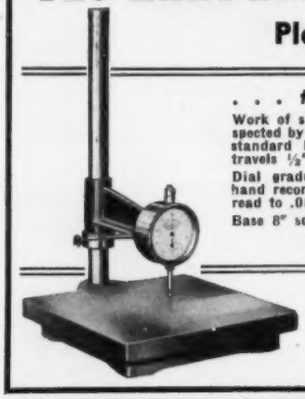

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Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit

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Producto Machine Co., Bridgeport, Conn.
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Zeh & Hahnemann Co., Newark, N. J.

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Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Inc., Binghamton, N. Y.
Strand & Co., N. A., Chicago

FILES, Rotary
Disston & Sons, Inc., Henry, Philadelphia
Hamilton Tool Co., Hamilton, O.
Strand & Co., N. A., Chicago

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Ames Co., B. C., Waltham, Mass.
Continental Machines Inc., Milwaukee
Do All Co., Inc., Des Plaines, Ill.
Illinois Tool Co., Chicago
Oliver Instrument Co., Adrian, Mich.

FILTERS, Air
Cleveland Pneu. Tool Co., Cleveland
Curtis Pneu. Machy. Co., St. Louis
Norton Company, Worcester, Mass.

FINGERS, Feed
Eastern Machine Screw Corp., New Haven, Conn.
Hardinge Brothers, Inc., Elmira, N. Y.
Mitts & Merrill, Saginaw, Mich.
Rivett Lathe & Grinder, Inc., Boston

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Watson-Stillman Co., Roselle, N. J.

FITTINGS, Wire-Rope
American Chain & Cable Co., Bridgeport, Conn.
American Steel & Wire Co., Chicago
Bethlehem Steel Co., Bethlehem, Pa.
Republic Steel Corp., Cleveland
Roebling's Sons Co., John A., Trenton, N. J.

FIXTURES, Indexing
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Hartford Special Machinery Co., Hartford, Conn.
Jefferson Mach. Tool Co., Cincinnati

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Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Machine Co., A. H., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Watson-Stillman Co., Roselle, N. J.
Yoder Co., Cleveland
Zeh & Hahnemann Co., Newark, N. J.

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General Electric Co., Schenectady, N. Y.
Surface Combustion Corp., Toledo, O.
Westinghouse Electric & Mfg. Co., E. Pittsburgh

FURNACES, Gas
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Chicago Flexible Shaft Co., Chicago
Hones, Inc., Chas. A. Baldwin, N. Y.
Stark Tool Co., Waltham, Mass.
Strong, Carlisle & Hammond Co., Cleveland
Surface Combustion Corp., Toledo, O.

FURNACES, Oil
Chicago Flexible Shaft Co., Chicago
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FURNITURE, Shop
Black & Decker Mfg. Co., Towson, Md. (Drill Stands)
Hamilton Tool Co., Hamilton, O.
New Britain-Gridley Machine Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.

GAGES, Amplifying
Federal Products Corp., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Van Keuren Co., Watertown, Mass.

GAGES, Caliper
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator
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Federal Products Corp., Providence, R. I.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
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Brown & Sharpe Mfg. Co., Providence, R. I.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Continental Machines, Inc., Minneapolis
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.

GAGES, Dial
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., Providence, R. I.
Randall & Stickney, Waltham, Mass.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Drill-Center
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Morse Twist Drill Co., New Bedford, Mass.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Continental Machines, Inc., Minneapolis
Lufkin Rule Co., Saginaw, Mich.
Scherr Co., Inc., Geo., N. Y. C.
Starrett Co., L. S., Athol, Mass.

GAGES, Plug & Ring
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Cadillac Gage Co., Detroit
Carboloy Co., Detroit
Crafts Co., Inc., Arthur A., Boston
Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
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Lincoln Park Tool & Gage Co., Lincoln Park, Mich.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div. Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T., Providence, R. I.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Gage Grinding Co., Ferndale, Mich.
Vard, Inc., Pasadena, Calif.
Van Keuren Co., Watertown, Mass.

GAGES, Pressure
Baldwin-Southwark Corp., Philadelphia
Brown Instrument Co., Philadelphia

GAGES, Profile
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Snap (See GAGES, Plug & Ring)

GAGES, Surface
Ames Co., B. C., Waltham, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

GAGES, Thickness
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Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney Co., Waltham, Mass.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Standard Gage Co., Poughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
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Detroit Tap & Tool Co., Detroit
Federal Products Corp., Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lufkin Rule Co., Saginaw, Mich.
Michigan Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Sheffield Corp., Dayton, O.
Slocomb Co., J. T. Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vard, Inc., Pasadena, Calif.

GAGES, Wire
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Brown & Sharpe Mfg. Co., Providence, R. I.
Disston & Sons, Inc., Henry, Philadelphia
Federal Products Corp., Providence, R. I.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland
Starrett Co., L. S., Athol, Mass.

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GASES, Compressed
Air Reduction, N. Y. C.

GEAR-CUTTING MACHINES
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Barber-Colman Co., Rockford, Ill.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Hobbing Mach. Co., Cleveland
Colonial Broach Co., Detroit
Cross Gear & Machine Co., Detroit
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt
General Mach. Corp., Hamilton, O.
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
National Broach & Machine Co., Detroit
National Tool Co., Cleveland
Newark Gear Cutting Mach. Co., Newark
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Scherr Co., Inc., Geo., N. Y. C.
Waltham Mach. Wks., Waltham, Mass.

GEAR-TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt
Gleason Works, Rochester, N. Y.
Illinois Tool Works, Chicago
Lees-Bradner Co., Cleveland
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Broach & Mach. Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scherr Co., Inc., Geo., N. Y. C.

GEARS, Cast
Braun Gear Corp., Brooklyn, N. Y.
Dodge Mfg. Corp., Mishawaka, Ind.
Earle Gear & Machine Co., Philadelphia
Fairfield Mfg. Co., Lafayette, Ind.
Farrel-Birmingham Co., Ansonia, Conn
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
General Electric Co., Schenectady, N. Y.
Grant Gear Works, Inc., Boston
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield Mass.
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GEARS, Cut
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Allis-Chalmers Mfg. Co., Milwaukee
Baush Mach. Tool Co., Springfield, Mass.
Bilgram Gear & Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
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Earle Gear & Machine Co., Philadelphia
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Farrel-Birmingham Co., Buffalo, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties Inc., Chicago
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Grant Gear Works, Inc., Boston
Hartford Special Machinery Co., Hartford, Conn.
Meisel Press Mfg. Co., Boston
Michigan Tool Co., Detroit
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Perkins Machine & Gear Co., Springfield, Mass.
Philadelphia Gear Works, Philadelphia
Sier-Bath Gear Co., North Bergen, N. J.
Stahl Gear & Machine Co., Cleveland

GEARS, Master
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Fellows Gear Shaper Co., Springfield, Vt.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

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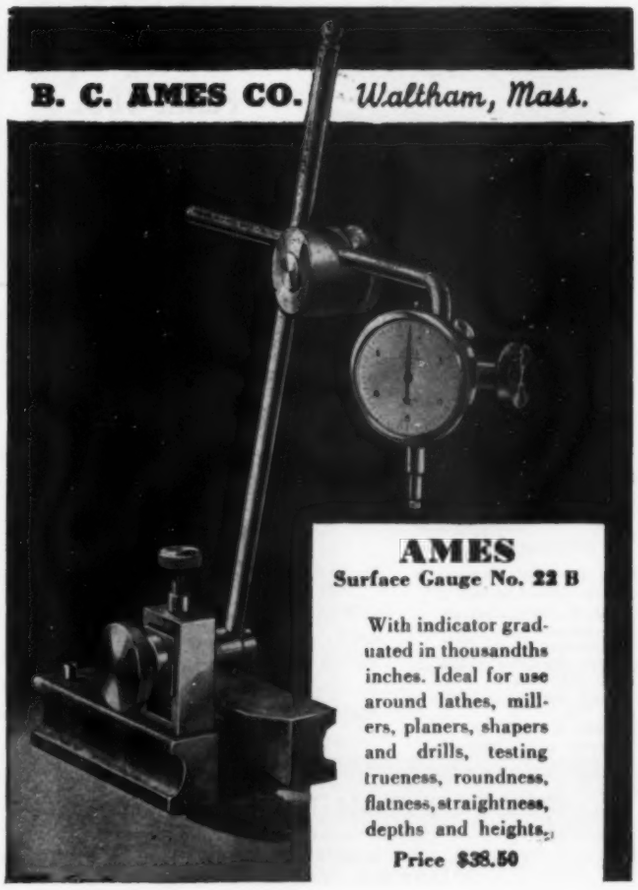

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Mattison Machine Works, Rockford, Ill.
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Walls Sales Corp., N. Y. C.

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Hardinge Brothers, Inc., Elmira, N. Y.
Hobart Brothers, Troy, Ohio
Norton Co., Worcester, Mass.
Porter Cable Mach. Co., Syracuse, N. Y.
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Queen City Machine Tool Co., Cincinnati
Schauer Machine Co., Cincinnati
Stow Mfg. Co., Binghamton, N. Y.
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Walker Co., O. S., Worcester, Mass.
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

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Norton Co., Worcester, Mass.

GRINDERS, Carbide Tool
Blount Co., J. G., Everett, Mass.
Ex-Cell-O Corp., Detroit
Hammond Machinery Bldrs., Inc., Kalamazoo, Mich.

GRINDERS, Centerless
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Heald Machine Co., Worcester, Mass.
Metal Carbides Corp., Youngstown, O.

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Bryant Chucking Grinder Co., Springfield, Vt.
Fitchburg Grinding Mach. Corp., Fitchburg, Mass.
Heald Machine Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.

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Blanchard Machine Co., Cambridge, Mass.
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Blount Co., J. G., Everett, Mass.
Boggis & Co., H. P., Cleveland
Boyar-Schultz Corp., Chicago
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Bryant Chucking Grinder Co., Springfield, Vt.
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National Acme Co., Cleveland
Norton Co., Worcester, Mass.
Oliver Instrument Co., Adrian, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Production Mach. Co., Greenfield, Mass.
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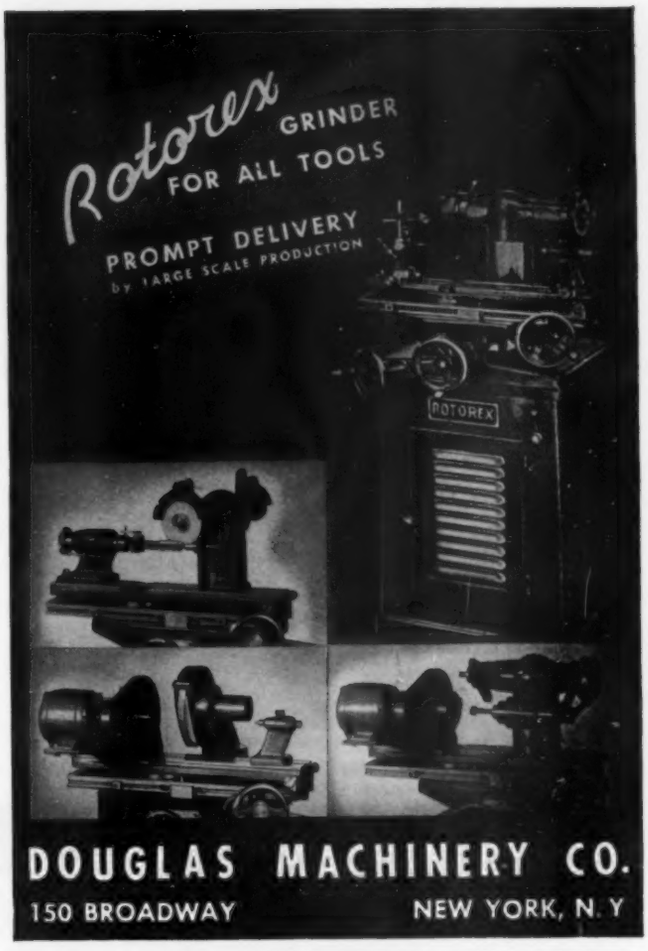

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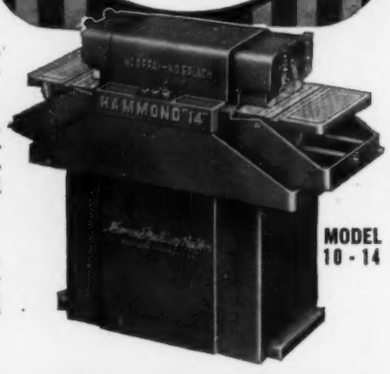

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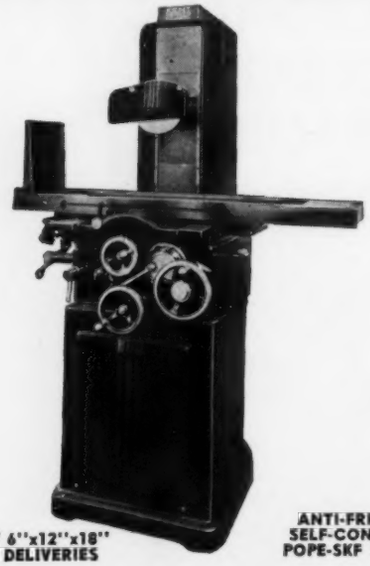

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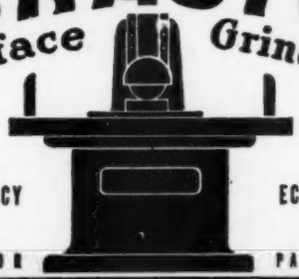

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Smallpiece, Ltd., Beverly, Mass.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Warner & Swasey Co., Cleveland
Wickman Corp., Detroit

LATHES, Bench
Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Blount Co., J. G., Everett, Mass.
Bradford Machine Tool Co., Cincinnati
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
LeBlond Mach. Tool Co., R. K., Cincinnati
Logan Engineering Co., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Rivett Lathe & Grinder, Inc., Boston
Schauer Machine Co., Cincinnati
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Sheldon Machine Co., Chicago
Sidney Machine Tool Co., Sidney, O.
South Bend Lathe Works, S. Bend, Ind.
Stark Tool Co., Waltham, Mass.
Walker-Turner Co., Inc., Plainfield, N. J
Warner & Swasey Co., Cleveland

LATHES, Crankshaft
American Tool Works, Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Machine Tool Co., Cincinnati
Potter & Johnston Machine Co., Pawtucket, R. I.
Sundstrand Mach. Tool Co., Rockford, Ill
Sunnen Products Co., St. Louis

LATHES, Double End
Consolidated Machine Tool Corp., Rochester, N. Y.
Jones & Lamson Machine Co., Springfield, Vt.

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WHERE-TO-BUY DIRECTORY

General Machy. Corp., Hamilton, Ohio
LeBlond Machine Tool Co., R. K., Cincinnati

LATHES, Engine & Toolroom
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., Los Angeles
Bradford Machine Tool Co., Cincinnati
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Gilbert Machine Tool Co., Cincinnati
Cincinnati Lathe & Tool Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Hendey Machine Co., Torrington, Conn.
LeBlond Mach. Tool Co., R. K., Cincinnati
Lodge & Shipley Mach. Tool Co., Cincinnati
Monarch Machine Tool Co., Sidney, O.
Morris Machine Tool Co., Cincinnati
Porter McLeod Mach. Tool Co., Hatfield, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Reed-Prentice Co., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Boston
Rockford Mach. Tool Co., Rockford, Ill
Seneca Falls Mach. Co., Seneca Falls N. Y.
Sheldon Machine Co., Chicago
Sidney Machine Tool Co., Sidney, O.
Simmons Mach. Tool Corp., Albany, N. Y
South Bend Lathe Works, S. Bend, Ind.

LATHES, Gun
American Tool Works Co., Cincinnati

LATHES, Shell
American Tool Works Co., Cincinnati
Bullard Co., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Cleveland Hobbing Machy. Co., Cleveland
Coulter Mach. Co., Jas., Bridgeport, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Lipe-Rollway Corp., Syracuse, N. Y.
Lodge & Shipley Mach. Tool Co., Cincinnati
Morey Machinery Co., Inc., N. Y. C.
Seneca Falls Mach. Co., Seneca Falls, N. Y.
Smallpeice, Ltd., Beverly, Mass.
Sundstrand Mach. Tool Co., Rockford, Ill.

LATHES, Turret
Acme Machine Tool Co., Cincinnati
Bardons & Oliver, Inc., Cleveland
Bullard Co., Bridgeport, Conn.
Cincinnati Lathe & Tool Co., Cincinnati
Diehl Machine Works, G. M., Wabash, Ind.
General Machinery Corp., Hamilton, O.
Gisholt Machine Co., Madison, Wis.
Goss & deLeeuw Machine Co., New Britain, Conn.
Greenlee Bros. & Co., Rockford, Ill
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
Monarch Machine Tool Co., Sidney, O.
Morey Machinery Co., Inc., N. Y. C.
National Acme Co., Cleveland
Potter & Johnston Machine Co., Pawtucket, R. I.
Simmons Mach. Tool Corp., Albany, N. Y.
South Bend Lathe Wks, South Bend, Ind.
Springfield Mach Tool Co., Springfield, O
Warner & Swasey Co., Cleveland

LEVELS, Precision
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Starrett Co., L. S., Athol, Mass.
Universal Boring Mach. Co., Hudson, Mass

LIGHTING EQUIPMENT, Industrial
Fleurolier Mfgrs., Cleveland
General Elec. Co., Nela Park, Cleveland
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., Cleveland

LOCK NUTS
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp., Elizabeth, N. J.
Fafnir Bearing Co., New Britain, Conn.
Standard Pressed Steel Co., Jenkintown Pa.

LUBRICANTS
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products, Inc., N. Y. C.
Shell Oil Corp., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. of Ind., Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Texas Co., N. Y. C.
Tidewater Oil Co., N. Y. C.

LUBRICATING SYSTEMS
American Cable Div., Am. Chain & Cable Co., Bridgeport, Conn.
De Laval Separator Co., N. Y. C.
Rivett Lathe & Grinder, Inc., Boston

MACHINE BASES
Clearing Machine Corp., Chicago
Littleford Bros., Cincinnati

MAGNETS, Lifting
General Electric Co., Schenectady, N. Y.

MALLETS (See TOOLS, Hand)

MANDRELS, Air Operated
Nicholson & Co., W. H., Wilkes-Barre, Pa.

MANDRELS, Expanding
Cleveland Twist Drill Co., Cleveland
Cushman Chuck Co., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Kearney & Trecker Corp., Milwaukee
Morse Twist Drill & Machine Co., New Bedford, Mass.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Producto Machine Co., Bridgeport, Conn.
Scully-Jones & Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.

MANDRELS, Solid (See ARBORS & MANDRELS)

MARKING MACHINES
Acromark Co., Elizabeth, N. J.
Gorton Machine Co., Geo., Racine, Wis.
Mathews & Co., James H., Pittsburgh

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INCREASED TABLE SIZE, TRAVEL AND GREATER CLEARANCE

● Important new developments on this machine make it adaptable to handling bigger jobs and insure the utmost in rigidity and accuracy. Improvements include:
. . . table size increased to 7" x 17½"
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. . . longitudinal table travel increased to 10" and cross travel to 6" without running out of ways.
. . . table hand wheel on left.
. . . maximum distance table top to spindle nose increased from 9" to 11½"
. . . column ways shortened at lower end to provide more clearance
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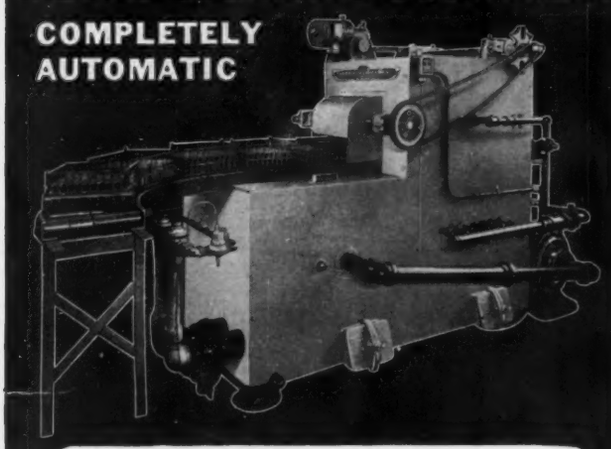
COMPLETELY AUTOMATIC



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Anti-friction speed and spindle assemblies.

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Numberall Stamp & Tool Co., Huguenot Park, N. Y.

MASKS (See **RESPIRATORS**)

MEASURING EQUIPMENT, Light Wave
Van Keuren Co., Watertown, Mass.

METAL-CLEANING EQUIPMENT
Barrett Co., Leon J., Worcester, Mass.
Barry-Wehmiller Machry. Co., St. Louis, Mo.
Buffard Co., Bridgeport, Conn.
Detroit Rex Products Co., Detroit
Hobart Bros. Co., Troy, O.
Stow Mfg. Co., Inc., Binghamton, N. Y.

METALS, Bearing
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
National Bearing Metals Corp., St. Louis
Ryerson & Son, Jos. T., Chicago
Westinghouse Electric & Mfg. Co., E. Pittsburgh

MICROMETERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Davis & Thompson Co., Milwaukee
Federal Products Corp., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Randall & Stickney, Waltham, Mass.
Scherr Co., Inc., George, N. Y. C.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

MICROSCOPES
Scherr Co., Geo., N. Y. C.

MILLERS, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Fitchburg Engrg. Corp., Fitchburg, Mass.
Kearney & Trecker Corp., Milwaukee
Kent-Owens Machine Co., Toledo, O.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.

MILLERS, Bench
Ames Co., B. C., Waltham, Mass.
Atlas Press Co., Kalamazoo, Mich.
Burke Machine Tool Co., Conneaut, O.
Granite State Mach. Co., Inc., Manchester, N. H.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati,
Linley Bros. Co., Bridgeport, Conn.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Stark Tool Co., Waltham, Mass.

MILLERS, Duplex
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., Milwaukee
Fitchburg Engrg. Corp., Fitchburg, Mass.
General Machinery Corp., Hamilton O.
Kearney & Trecker Corp., Milwaukee
Producto Machine Co., Bridgeport, Conn.
Snyder Tool & Engrg. Co., Detroit
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool Co., Springfield, Mass.

MILLERS, Hand
Atlantic Machinery Co., N. Y. C.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati
Kent-Owens Machine Co., Toledo, O.
Lucas & Sons, Inc., J. L., Bridgeport, Conn.
Nichols & Sons, W. H., Waltham, Mass.
Producto Machine Co., Bridgeport, Conn.
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Mach. Tool. Co., Springfield, Mass.

MILLERS, Plain & Universal
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Douglas Machinery Co., Inc., N. Y. C.
Fray Mach. Tool Co., Glendale, Calif.
Gorton Machine Co., Geo., Racine, Wis.
Granite State Mach. Co., Inc., Manchester, N. H.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati
Kearney & Trecker Corp., Milwaukee
Kempsmith Machine Co., Milwaukee
Kent-Owens Machine Co., Toledo, O.
Lucas & Son, Inc., J. L., Bridgeport, Conn.
Knight Machinery Co., W. B., St. Louis
Machinery Mfg. Co., Chicago
Nichols & Sons, W. H., Waltham, Mass.
Ohio Machine Tool Co., Kenton, O.
Producto Machine Co., Bridgeport, Conn.
Sidney Machine Tool Co., Sidney, O.
Van Norman Machine Tool Co., Springfield, Mass.

MILLERS, Planer Type
Cincinnati Planer Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Fitchburg Engrg. Corp., Fitchburg, Mass.
General Machinery Corp., Hamilton, O.
Gidding & Lewis Mach. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., Milwaukee
Sellers & Co., Inc., Wm., Philadelphia

MILLERS, Planetary
Hall Planetary Co., Philadelphia
Plan-O-Mill Corp., Royal Oak, Mich.

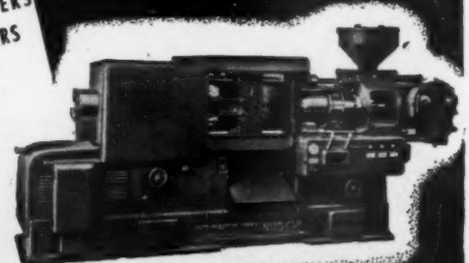
MILLERS, Profile
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machinery Co., W. B., St. Louis
Morey Machinery Co., Inc., N. Y. C.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Mach. Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.

MILLERS, Thread
Adams Co., Dubuque, Iowa
Cleveland Auto. Mach. Co., Cleveland
Coulter Mach. Co., Jas., Bridgeport, Conn.
Hanson-Whitney Mach. Co., Hartford, Conn.
Lees-Bradner Co., Cleveland
Plan-O-Mill Corp., Royal Oak, Mich.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Rivett Lathe & Grinder, Inc., Boston
Scherr Co., Inc., Geo., N. Y. C.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Waltham Mach. Works, Waltham, Mass.

MILLERS, Vertical
Blank & Buxton Machy. Co., Jackson, Mich.

REED-PRENTICE

INJECTION MOLDERS
VERTICAL MILLERS
DIE CASTERS
DIE SINKERS
JIG BORERS
LATHES



REED-PRENTICE CORP. WORCESTER, MASS., U. S. A.

WHERE-TO-BUY DIRECTORY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati
Consolidated Mach. Tool Corp., Rochester, N. Y.
Coulter Machine Co., James, Bridgeport, Conn.
General Machinery Corp., Hamilton, O.
Gorton Machine Co., Geo., Racine, Wis.
Granite State Mach. Co., Inc., Manchester. N. H.
Hardinge Brothers, Inc., Elmira, N. Y.
Jefferson Mach. Tool Co., Cincinnati
Kearney & Trecker Corp., Milwaukee
Kempsmith Mfg. Co., Milwaukee
Kent-Owens Machine Co., Toledo, Ohio
Knight Machinery Co., W. B., St. Louis
Linley Bros. Co., Bridgeport, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Producto Machine Co., Bridgeport, Conn.
Reed-Prentice Corp., Worcester, Mass.
Sidney Machine Tool Co., Sidney, O.
Sommer & Adams Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Van Norman Machine Tool Co., Springfield, Mass.

MOLDING MACHINES, Plastic
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Reed-Prentice Corp., Worcester, Mass.
Watson-Stillman Co., Roselle, N. J.

MOLDS, Lead Hammer
Johnson Tool Co., Inc., E. Providence, R. I.

MOTORS, Electric
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Century Electric Co., St. Louis
Dumore Co., Racine, Wis.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee
Howell Elec. Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Wesche Electric Co., B. A., Cincinnati
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

MOTORS, Geared (See **MOTORS, Electric**)

MOTORS, Hydraulic (see also **PUMPS, Hydraulic**)
Racine Tool & Mach. Co., Racine, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill
Vickers, Inc., Detroit

NAMEPLATES
Acromark Co., Elizabeth, N. J.
Matthews & Co., Jas. H., Pittsburgh
Noble & Westbrook Mfg. Co., Hartford. Conn.

NIBBLERS
Campbell, Andrew C., Div. Amer. Chain & Cable Co., Bridgeport, Conn.
Mitts & Merrill, Saginaw, Mich.
Savage Tool Co., Savage, Minn.

NOZZLES, Blast-Cleaning
Littell Machine Co., F. J., Chicago
Norton Company, Worcester, Mass.
Schrader's Sons, A., N. Y. C.

NUMBERING MACHINES (See **MARKING MACHINES**)

NUT-BLANKING MACHINES
Cleveland Automatic Mach. Co., Cleveland
National Acme Co., Cleveland
Potter & Johnston Machine Co., Pawtucket, R. I.

OIL STONES (See **STONES, Sharpening**)

OILERS, Automatic (See **LUBRICATING SYSTEMS**)

OILS, Cutting
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
National Refining Co., Cleveland
Ohio Oil Co., Findlay, Ohio
Racine Tool & Mach. Co., Racine, Wis
Shell Oil Co., Inc., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Swan-Finch Oil Corp., N. Y. C.
Texas Co., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.
White & Bagley Co., Worcester, Mass.

OILS & GREASES (See **LUBRICANTS**)

OILS, Hydraulic
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Shell Oil Co. Inc., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Sun Oil Co., Philadelphia
Texas Co., N. Y. C.
Tidewater Associated Oil Co., N. Y. C.

OILS, Quenching & Tempering
Cities Service Co., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Shell Oil Co., Inc., N. Y. C.
Sinclair Refining Co., N. Y. C.
Socony-Vacuum Oil Co., N. Y. C.
Standard Oil Co. (Ind.), Chicago
Stuart Oil Co., D. A., Chicago
Sun Oil Co., Philadelphia
Texas Co., N. Y. C.
Tidewater Oil Co., N. Y. C.

PACKING, Hydraulic
Elmes Engrg. Wks., Chas. F., Chicago
Greene, Tweed & Co., N. Y. C.
Houghton & Co., E. F., Philadelphia
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Watson-Stillman Co., Roselle, N. J.

PAINTS, Varnishes, etc.
Devoe & Raynolds Co., Inc., N. Y. C.

PAPER & CLOTH, Abrasive
Behr-Manning Corp., Troy, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Midwest Abrasive Co., Detroit

PARALLELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S., Worcester, Mass.

PHOSPHOR BRONZE
Bunting Brass & Bronze Co., Toledo
Johnson Bronze Co., New Castle, Pa.

PICKLING MACHINES (See **METAL-CLEANING EQUIPMENT**)

PINS, Dowel & Taper
Allen Mfg. Co., Hartford, Conn.
American Steel & Wire Co., Cleveland
Bethlehem Steel Co., Bethlehem, Pa.
Danly Machine Specialties, Inc., Chicago
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

PIPE CUTTING & THREADING MACHINES
Armstrong Bros. Tool Co., Chicago
Bardons & Oliver, Inc., Cleveland
Cleveland Automatic Mach. Co., Cleveland
Hill Acme Co., Cleveland
Landis Mach. Co., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Rickert-Shafer Co., Erie, Pa.
Scherr Co., Inc., Geo., N. Y. C.
Warner & Swasey Co., Cleveland

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Save time and money—keep lead hammers in good condition at all times—easy to use—fast. Made in 7 sizes for hammers from 1 to 11 lbs. Write for details.
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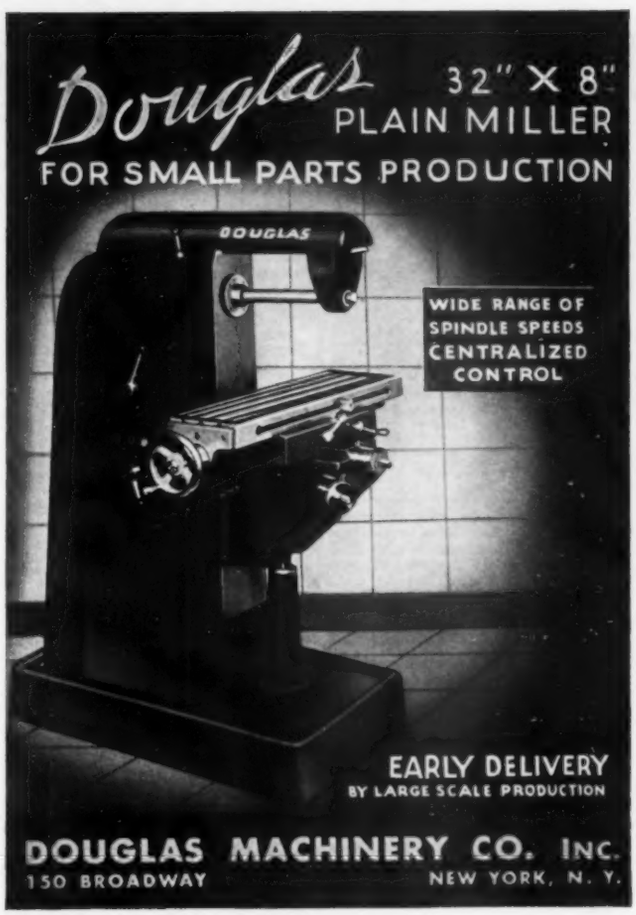

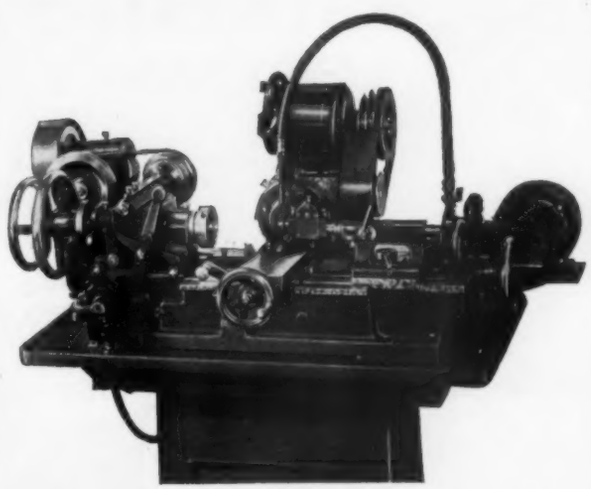

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WITH 3 MOTOR DRIVE

A semi-automatic machine for production or tool room service. It is best adapted for work 2" in diameter or smaller. Special equipment for short multiple cutter work with cam shaft control can be furnished. A cutter head for internal work can also be supplied.

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HIGH STREET WALTHAM, MASS.

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Cleveland Punch & Shear Works Co., Cleveland
Consolidated Mach. Tool Corp., Rochtester, N. Y.
General Machinery Corp., Hamilton, O.
Liberty Planers, Inc., Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Rockford Mach. Tool Co., Rockford, Ill.
Sellers & Co., Inc., Wm., Philadelphia

PLANERS, Plate
Baldwin-Southwark Corp., Philadelphia
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Mach. Tool Corp., Rochester, N. Y.
General Machinery Corp., Hamilton, O.
Ohio Machine Tool Co., Kenton, O.
Sellers & Co., Wm., Philadelphia

PLATES, Angle
Brown & Sharpe Mfg. Co., Providence, R. I.
Lombard Governor Corp., Ashland, Mass.
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Smith Tool and Engrg. Co., Bucyrus, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

PLATES, Surface
Baumbach Mfg. Co., E. A., Chicago
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Mfg. Co., Milwaukee
Lombard Governor Corp., Ashland, Mass.
Machine Products Corp., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Smith Tool & Engrg. Co., Bucyrus, O.
Starrett Co., L. S., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

PLATFORMS, SKID (See **TRUCKS, Hand Lift**)

PLATING, Brass, Chromium, Copper
Chromium Corp. of Amer., N. Y. C.
Industrial Chromium Corp., Holyoke, Mass.

PLATING, Spot
Industrial Chromium Corp., Holyoke, Mass.

POTENTIOMETERS
Brown Instrument Co., Philadelphia
General Electric Co., Schenectady, N. Y.

POTS, Melting
Farrell-Birmingham Co., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Hones, Inc., Chas. A., Baldwin, N. Y.
Strong, Carlisle & Hammond Co., Cleveland
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.

PRESSES, Arbor
American Broach & Machine Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Fameo Machine Co., Racine, Wis.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lempco Products, Inc., Bedford, O.
Lucas Machine Tool Co., Cleveland
Nicholson & Co., W. H. Wilkes-Barre, Pa.
Producto Machine Co., Bridgeport, Conn.
Sheldon Machine Co., Chicago
Tomkins-Johnson Co., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Buffalo, N. Y.
Wright Mfg. Div., American Chain & Cable Co., York, Pa.

PRESSES, Crank (See **PRESSES, Power**)

PRESSES, Foot
Etna Machine Co., Toledo, O.
Fameo Machine Co., Racine, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Rockford Iron Works, Inc., Rockford, Ill.
V. & O. Press Co., Hudson, N. Y.

PRESSES, Forging
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Cleveland Punch & Shear Works Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Hill Acme Co., Cleveland
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Hydraulic
American Broach & Machine Co., Ann Arbor, Mich.
Atlas Press Co., Kalamazoo, Mich.
Baldwin-Southwark Corp., Philadelphia
Beatty Mach. & Mfg. Co., Hammond, Ind.
Bethlehem Steel Co., Bethlehem, Pa.
Clearing Machine Corp., Chicago
Colonial Broach Co., Detroit
Davis Keyseater Co., Rochester, N. Y.
Elmes Engrg. Wks., Chas. F., Chicago
Farrel-Birmingham Co., Ansonia, Conn.
General Machinery Corp., Hamilton, O.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Lempco Products, Inc., Bedford, O.
Tomkins-Johnson Co., Jackson, Mich.
Watson-Stillman Co., Roselle, N. J.
Wright Mfg. Div. Amer. Chain Co. Inc., Bridgeport, Conn.

PRESSES, Power (Punch)
Beatty Mach. & Mfg. Co., Hammond, Ind.
Buffalo Forge Co., Bpffalo, N. Y.
Cincinnati Shaper Co., Cincinnati
Clearing Mach Co., Chicago
Cleveland Crane & Engrg. Co., Steelweld Machry. Div., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., Cleveland.
Consolidated Machine Tool Corp., Rochester, N. Y.
Davis Keyseater Co., Rochester, N. Y.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hendey Machine Co., Torrington, Conn.
Henry & Wright Mfg. Co., Hartford, Conn.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Kent-Owens Machine Co., Toledo, O.
Lempco Products, Inc., Bedford, O.
Mitts & Merrill, Saginaw, Mich.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Nilson Mach. Co., A. H. Bridgeport, Conn.
Rockford Iron Works, Inc., Rockford, Ill.
Ryerson & Son, Inc., Jos. T., Chicago
Schatz Mfg. Co., Poughkeepsie, N. Y.
V. & O. Press, Hudson, N. Y.
Wiedemann Machine Co., Philadelphia
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Screw
Barnes Co., W. F. & John, Rockford, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Producto Machine Co., Bridgeport, Conn.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Wright Mfg. Div., American Chain & Cable Co., York, Pa.
Zeh & Hahnemann Co., Newark, N. J.

PRESSES, Straightening
Baldwin-Southwark Corp., Philadelphia
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N. Y.
Elmes Engrg. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Nilson Mach. Co., A. H., Bridgeport, Conn.
Springfield Mach. Tool Co., Springfield, O.
Watson-Stillman Co., Roselle, N. J.

PRESSES, Turret Punch
Federal Press Co., Elkhart, Ind.
Wiedemann Machine Co., Philadelphia

PROFILERS (See **MILLERS, Vertical**)

PROJECTORS, Contour
Jones & Lamson Machine Co., Springfield, Vt.
Portman Machine Tool Co., Mt. Vernon, N. Y.
Scherr Co., Geo., N. Y. C.

PROTRACTORS, Optical
Scherr Co., Geo., N. Y. C.

PULLEYS, Iron, Steel & Wood
American Pulley Co., Philadelphia
Brown & Sharpe Mfg. Co., Providence, R. I.
Carlyle Johnson Machine Co., Manchester, Conn.
Dayton Rubber Mfg. Co., Dayton, O.
Dodge Mfg. Corp., Mishawaka, Ind.
Hill Acme Co., Cleveland
Reeves Pulley Co., Columbus, Ind.

PULLEYS, V-Belt (See **SHEAVES, V-Belt**)

PUMPS, Centrifugal
Allis-Chalmers Mfg. Co., Milwaukee
Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Engrg. & Mfg. Co., Detroit
Ruthman Machry. Co., Cincinnati
Tomkins-Johnson Co., Jackson, Mich.

PUMPS, Hydraulic
Allis-Chalmers Mfg. Co., Milwaukee
Baldwin-Southwark Corp., Philadelphia
Barnes Co., W. F. & John, Rockford, Ill.
Elmes Engrg. Wks., Chas. F., Chicago
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Lapointe Mach. Tool Co., Hudson, Mass
Racine Tool & Machine Co, Racine, Wis.
Sundstrand Mach. Tool Co., Rockford, Ill.
Tuthill Pump Co., Chicago
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.

PUMPS, Lubricant and Coolant
Brown & Sharpe Mfg. Co., Providence, R. I.
Buffalo Forge Co., Buffalo, N. Y.
Gray Mills Co., Chicago
Pioneer Engrg. & Mfg. Co., Detroit
Rivett Lathe & Grinder, Inc., Boston
Ruthman Machinery Co., Cincinnati
Sundstrand Mach. Tool Co., Rockford, Ill.
Tompkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., Chicago
Vickers, Inc., Detroit

PUNCHES, Center & Hand (See **TOOLS, Hand**)

PURIFIERS, Oil & Coolant
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.

PYROMETERS, Indicating & Recording
Brown Instrument Co., Philadelphia

QUENCHERS
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Farrel-Birmingham Co., Buffalo, N. Y.
Gleason Works, Rochester, N. Y.

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RASPS (See FILES & RASPS)

RATCHETS (See GEARS, Cut)

REAMERS, Adjustable
Barber-Colman Co., Rockford, Ill.
Black Drill Co., Cleveland
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Gairing Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., Meadville, Pa.
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.

REAMERS, Pipe
American Swiss File & Tool Co., Elizabeth, N. J.
Armstrong Bros. Tool Co., Chicago
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Cleveland Twist Drill Co., Cleveland
Detroit Tap & Tool Co., Detroit
Gairing Tool Co., Detroit
Greenfield Tap & Die Corp., Greenfield, Mass.
Michigan Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Oster Mfg. Co., Cleveland
Standard Tool Co., Cleveland
Torrington Co., Torrington, Conn.

REAMERS, Shell
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Greenfield Tap & Die Corp., Greenfield, Mass.
Illinois Tool Works, Chicago
Morse Tool Co., Detroit
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Schultz & Anderson Co., Newark, N. J.
Union Twist Drill Co., Athol, Mass.

REAMERS, Solid
Barber-Colman Co., Rockford, Ill.
Butterfield & Co., Derby Line, Vt
C. & W. Tool Co., Cambridge, Mass.
Carboloy Co., Inc., Detroit
Cleveland Twist Drill Co., Cleveland
Colonial Broach Co., Detroit
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Firth-Sterling Steel Co., McKeesport, Pa.
Gairing Tool Co., Detroit
Genesee Tool Co., Detroit
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., N. Y. C.
Holman Reamer Co., Manchester, Conn.
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Tool Co., Cleveland
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Scully-Jones & Co., Chicago
Standard Tool Co., Cleveland
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Vascoloy-Ramet Corp., N. Chicago, Ill.
Wendt Sonis Co., Hannibal, Mo.
Whitman & Barnes, Detroit

REAMING MACHINES
Blanchard Machine Co., Cambridge, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Cleveland Pneu. Tool Co., Cleveland
Rotor Tool Co., Cleveland
Van Norman Machine Tool Co., Springfield, Mass.

RECORDERS, Speed (See INDICATORS, Speed)

RECORDERS, Temperature & Pressure
Brown Instrument Co., Philadelphia

REDUCERS, Motorized Speed
Allis-Chalmers Mfg. Co., Milwaukee
Barber-Colman Co., Rockford, Ill.
Dumore Co., Racine, Wis.
Earle Gear & Machine Co., Philadelphia
Foote Bros. Gear & Mach. Co., Chicago
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
James Co., D. O., Chicago
Meisel Press Mfg. Co., Boston, Mass.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Reliance Elec. & Engrg. Co., Cleveland
Wagner Electric Corp., St. Louis
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

REDUCERS, Speed
Adams Co., Dubuque, Iowa
Davis & Thompson Co., Milwaukee
Earle Gear & Machine Co., Philadelphia
Farrel-Birmingham Co., Buffalo, N. Y.
Ganschow Gear Co., Chicago
Gear Specialties, Inc., Chicago
General Electric Co., Schenectady, N. Y.
General Machinery Corp., Hamilton, O.
Grant Gear Works, Inc., Boston
James Co., D. O., Chicago
Morse Chain Co., Ithaca, N. Y.
Ohio Gear Co., Cleveland
Philadelphia Gear Works, Philadelphia
Racine Tool & Mach. Co., Racine, Wis.
Stahl Gear & Machine Co., Cleveland
Sundstrand Mach. Tool Co., Rockford, Ill.
Vickers, Inc., Detroit
Watson-Stillman Co., Roselle, N. J.
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

REELS, Strip-Stock & Wire
Littell Machine Co., F. J., Chicago
Nilson Mach. Co., A. H., Bridgeport, Conn.
Yoder Co., Cleveland

REFRACTORIES
Bay State Abrasive Products Co., Westboro, Mass.
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
Strong, Carlisle & Hammond Co., Cleveland

REGULATORS, Speed
Vickers, Inc., Detroit

REGULATORS, Temperature
American Gas Furn. Co., Elizabeth, N. J.
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Philadelphia

RIFLING MACHINES, Gun
American Broach & Machine Co., Ann Arbor, Mich.
Illinois Tool Works, Chicago
LeBlond Mach. Tool Co., R. K., Cincinnati
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.

RIVETERS, Electric Power
Buffalo Forge Co., Buffalo, N. Y.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Linley Bros. Co., Bridgeport, Conn.
Tomkins-Johnson Co., Jackson, Mich.

RIVETERS, Pneumatic & Hydraulic
Baldwin-Southwark Corp., Philadelphia
Cleveland Pneu. Tool Co., Cleveland
Elmes Engrg. Wks., Chas. F., Chicago
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Watson-Stillman Co., Roselle, N. J.

RIVETS
Aluminum Co. of America, Pittsburgh
American Steel & Wire Co., Pittsburgh
Bethlehem Steel Co., Bethlehem, Pa.

ROLLS, Bending
Baldwin-Southwark Corp., Philadelphia
Buffalo Forge Co., Buffalo, N. Y.
Cleveland Punch & Shear Works Co., Cleveland
Consolidated Machine Tool Corp., Rochester, N.Y.
General Machinery Corp., Hamilton, O.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Ryerson & Son, Inc., Jos. T., Chicago

ROLLS, Forging
Bethlehem Steel Co., Bethlehem, Pa.

ROPE, Wire
American Cable Div. of Am. Chain & Cable Co., N. Y. C.
Bethlehem Steel Co., Bethlehem, Pa.
Page Steel & Wire Div., Am. Chain & Cable Co., Monessen, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Ryerson & Son, Inc., Jos. T., Chicago

ROUTERS
Consolidated Mach. Tool Corp., Rochester, N. Y.
Gorton Machine Co., Geo., Racine, Wis.
Knight Machy. Co., W. B., St. Louis
Onsrud Machine Works, Chicago
Reed-Prentice Corp., Worcester, Mass.

RULES & TRIANGLES, Machinists'
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.
Van Keuren Co., Watertown, Mass.

RUSTPROOFING & SLUSHING COMPOUNDS
Bakelite Corp., N. Y. C.
Gulf Oil Corp., Pittsburgh
Houghton & Co., E. F., Philadelphia
Oakite Products Co., N. Y. C.
Socony-Vacuum Oil Co., Inc., N. Y. C.
Standard Oil Co. of Indiana, Chicago
Tidewater Oil Co., N. Y. C.

SAFETY EQUIPMENT
American Optical Co., Southbridge, Mass.
Littleford Bros., Cincinnati

SANDERS, Machine & Portable
Black & Decker Mfg. Co., Towson, Md.
Carborundum Co., Niagara Falls, N. Y.
Delta Mfg. Co., Milwaukee
Haskins Co., R. G., Chicago
Jefferson Machine Tool Co., Cincinnati
Mattison Machine Works, Rockford, Ill.
Porter-Cable Mach. Co., Syracuse, N. Y.
Production Mach. Co., Greenfield, Mass.
Rotor Tool Co., Cleveland
Skilsaw, Inc., Chicago
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Plainfield, N. J.
Walls Sales Corp., N. Y. C.

SAW BLADE GRINDING FIXTURES
Industrial Engrg. Co., Inc., Minneapolis

SAW BLADES, Circular Metal-Cutting
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Barber-Colman Co., Rockford, Ill.
Brown & Sharpe Mfg., Co., Providence, R. I.
Butterfield & Co., Derby Line, Vt.
Carboloy Co., Inc., Detroit
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Illinois Tool Works, Chicago
Michigan Tool Co., Detroit
Morse Twist Drill & Mach. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Detroit
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Standard Tool Co., Cleveland

SAW BLADES, Hack & Band (See BLADES, Hack & Band-Saw)

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Continental Machines, Inc., Minneapolis
Delta Mfg. Co., Milwaukee
Peerless Machine Co., Racine, Wis.
Racine Tool & Machine Co., Racine, Wis.
Reed-Prentice Corp., Worcester, Mass.
Ryerson & Son, Inc., Jos. T., Chicago
Starrett Co., L. S., Athol, Mass.
Walker-Turner Co., Plainfield, N. J.

SAWS, Circular, Metal-Cutting (Machines)
Consolidated Mach. Tool Corp., Rochester, N. Y.
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony Philadelphia
Earle Gear Machine Co., Philadelphia
Motch & Merryweather Co., Cleveland
Porter-McLeod Machine Tool Co., Hatfield, Mass.

SAWS, Circular, Wood-Cutting (Machine)
Atkins & Co., E. C., Indianapolis
Curtis Pneumatic Machy. Co., St. Louis
Delta Mfg. Co., Milwaukee
Disston & Sons, Inc., Henry, Tacony, Philadelphia
Mattison Machine Works, Rockford, Ill.
Walker-Turner Co., Inc., Plainfield, N. J.

SAWS, Friction
Ryerson & Son, Inc., Jos. T., Chicago

SAWS, Hack (See **TOOLS, Hand**)

SAWS, Hole
Armstrong-Blum Co., Chicago
Atkins & Co., E. C., Indianapolis
Avey Drilling Mach. Co., Cincinnati
Black & Decker Mfg. Co., Towson, Md.
Earle Gear & Machine Co., Philadelphia
Schrader's Sons, A., N. Y. C.
Skilsaw, Inc., Chicago

SAWS, Portable (See **TOOLS, Portable**)

SAWS, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Atkins & Co., E. C., Indianapolis
Capewell Mfg. Co., Hartford, Conn.
Covel Mfg. Co., Benton Harbor, Mich.
L-W Chuck Co., Toledo, Ohio
Oster Mfg. Co., Cleveland
Peerless Machine Co., Racine, Wis.
Racine Tool & Mach Co., Racine, Wis.
Ryerson & Son, Inc., Jos. T., Chicago

SCRAPERS, Hand (See **TOOLS, Hand**)

SCRAPERS, Power
Black & Decker Mfg. Co., Towson, Md.

SCREWDRIVERS, Flexible-Shaft (See **TOOLS, Flexible-Shaft**)

SCREWDRIVERS, Hand (See **TOOLS, Hand**)

SCREWDRIVERS, Portable Electric & Pneumatic (See **TOOLS, Portable**)

SCREWDRIVING & NUT-SETTING MACHINES
Bodine Corp., Bridgeport, Conn.
Haskins Co., R. G., Chicago
Producto Machine Co., Bridgeport, Conn.
Schauer Machine Co., Cincinnati
Strand & Co., N. A., Chicago

SCREW-MACHINES, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Cone Automatic Mach. Co., Windsor, Vt.
Foote-Burt Co., Cleveland
Greenlee Bros. & Co., Rockford, Ill.
National Acme Co., Cleveland
New Britain-Gridley Mach. Div., New Britain, Conn.
Scherr Co., Inc., George, N. Y. C.
Warner & Swasey Co., Cleveland

SCREW-MACHINES, Plain & Hand
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland
Gisholt Machine Co., Madison, Wis.
Hardinge Brothers, Inc., Elmira, N. Y.
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Cleveland
Rivett Lathe & Grinder, Inc., Boston
Warner & Swasey Co., Cleveland

SCREW PLATES (See **DIES, Screw-Cutting, Adjustable**)

SCREWS, Cap and Set
Allen Mfg. Co., Hartford, Conn.
Baumbach Mfg. Co., E. A., Chicago
Danly Machine Specialties, Inc., Chicago
Eastern Machine Screw Corp., New Haven, Conn.
National Acme Co., Cleveland
Parker-Kalon Corp., N. Y. C.
Republic Steel Corp., Cleveland, O.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Machine
Allen Mfg. Co., Hartford, Conn.
Eastern Machine Screw Corp., New Haven, Conn.
Lamson & Sessions Co., Cleveland
Republic Steel Co., Cleveland
Strong, Carlisle & Hammond Co., Cleveland

SCREWS, Recessed Head
American Screw Co., Providence, R. I.
Central Screw Co., Chicago
Chandler Products Corp., Cleveland
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corp., New Britain, Conn.
International Screw Co., Detroit
National Screw & Mfg. Co., Cleveland
New England Screw Co., Keene, N. H.
Parker Co., Charles, Meriden, Conn.
Parker-Kalon Corp., N. Y. C.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Mfg. Co., Chicago, Ill.
Phillips Screw Mfrs. Providence, R. I.
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Scovill Mfg. Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago
Southington Hardware Mfg. Co., Southington, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Whitney Screw Corp., Nashua, N. H.

SCREWS, Self-Tapping
Parker-Kalon Corp., N. Y. C.

SCREWS, Thumb & Wing
Parker-Kalon Corp., N. Y. C.

SCRIBERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett Co., L. S., Athol, Mass.

SEPARATORS, Centrifugal
Barrett Co., Leon J., Worcester, Mass.
DeLaval Separator Co., N. Y. C.
National Acme Co., Cleveland

SETS, Rivet
American Swiss File & Tool Co., Elizabeth, N. J.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., Cleveland

SETTERS, Nut (See **TOOLS, Portable**)

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Earle Gear & Mach. Co., Philadelphia
Jones & Laughlin Steel Corp., Pittsburgh
National Tube Co., Pittsburgh
Ryerson & Son, Inc., Jos. T., Chicago
Scully Steel Products Co., N. Y. C.
Union Drawn Steel Co., Massillon, O.
Wyckoff Drawn Steel Co., Pittsburgh

SHAFTS, Flexible
Dumore Co., Racine, Wis.
Errington Mech. Lab., Stapleton, N. Y.
Haskins Co., R. G., Chicago
Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn.
Stow Mfg. Co., Binghamton, N. Y.
Strand Co., N. A., Chicago
Walker-Turner Co., Inc., Plainfield, N. J.

SHAPERS
American Tool Works Co., Cincinnati
Ames Co., B. C., Waltham, Mass.
Atkins & Co., E. C., Indianapolis
Atlas Press Co., Kalamazoo, Mich.
Automotive Maintenance Machinery Co., N. Chicago, Ill.
Bryant Machinery & Engrg. Co., Chicago
Cincinnati Shaper Co., Cincinnati
Hanson-Whitney Mach. Co., Hartford, Conn.
Hendey Machine Co., Torrington, Conn.
Machinery Mfg. Co., Los Angeles
Morey Machinery Co., Inc., N. Y. C.
Ohio Machine Tool Co., Kenton, O.
Pratt & Whitney Div., Niles-Bement-Bond Co., Hartford, Conn.
Reed-Prentice Corp., Worcester, Mass.
Rockford Mach. Tool Co., Rockford, Ill.
Smith & Mills Co., Cincinnati

SHARPENERS, Saw
Detroit Tap & Tool Co., Detroit
Ex-Cell-O Corp., Detroit
Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., Detroit
National Broach & Mach. Co., Detroit
Weldon Tool Co., Cleveland

SHAVING MACHINES
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Gear & Machine Co., Detroit
Michigan Tool Co., Detroit

SHEARS, Hand
Black & Decker Mfg. Co., Towson, Md.
Buffalo Forge Co., Buffalo, N. Y.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Minneapolis

SHEARS, Rotary
Cleveland Punch & Shear Works Co., Cleveland

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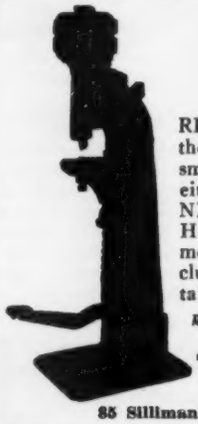

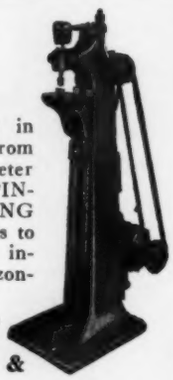

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Cunningham Co., M. E., Pittsburgh
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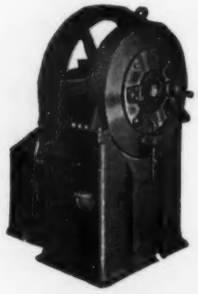

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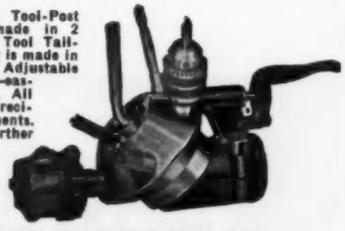

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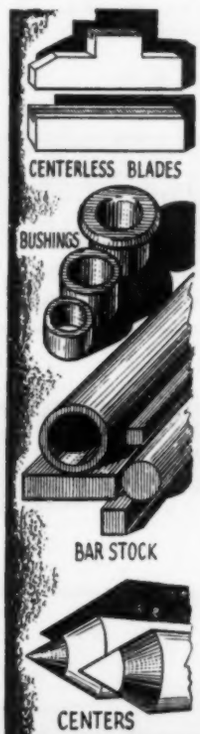

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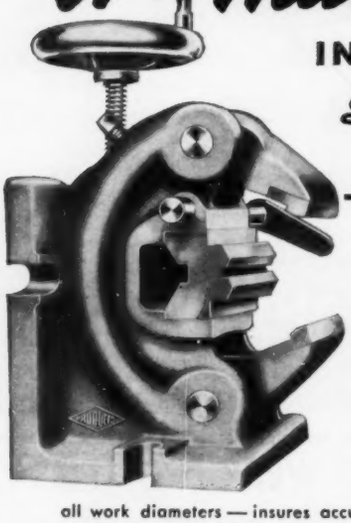

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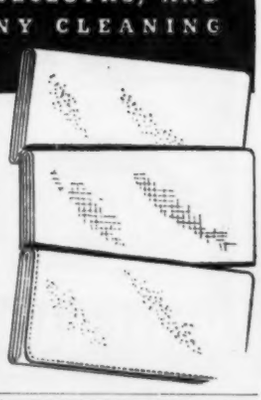

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First off, in setting up a new lathe *read your instruction book.* We put an awful lot of care into a LeBlond to get the accuracy shown on its inspection test card. But we might just as well spend our time fishing if you insist on not setting it level. An ordinary carpenter's level won't do,— it's not nearly sensitive enough. It takes a precision ground bulb level. You also want to use this instrument to check the alignment of the older machines from time to time.

After you are set up according to the book, study the lubrication chart. This is important. Look at the pictures below. These are the spots that need oiling every day.

Yours truly,
Greater G. P. Laton

NOT THIS WAY

Head Stock — Don't let oil level get below one inch from top of intake. Use a good grade of machine oil SAE 30.

Tailstock — This top unscrews. Keep the felt filtering pad saturated by daily oilings from a can.

Apron — Keep SAE 30 oil at a level where it can be seen at intake. Work plunger in and out slowly 3 or 4 times daily.

Feed Box — Keep the felt filtering pad in the trough saturated by daily oilings from a can.

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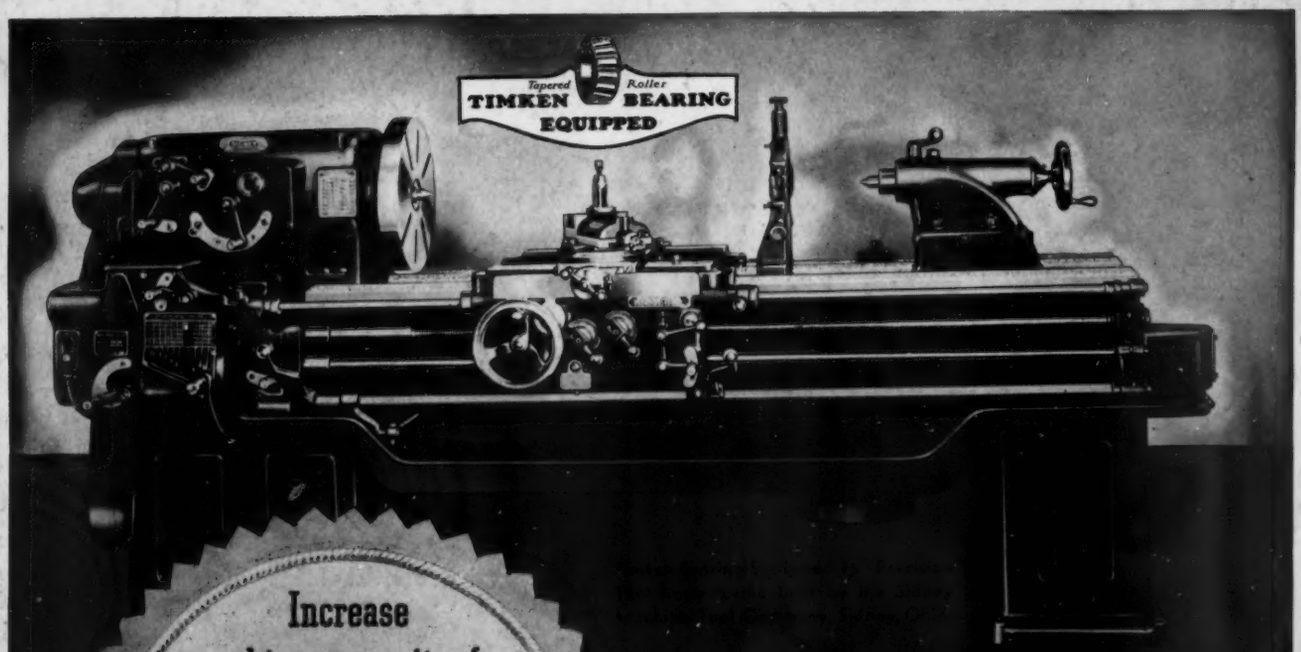
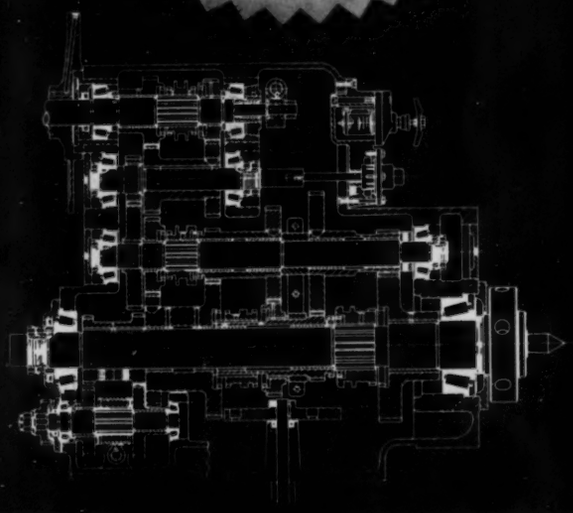
Cincinnati, Ohio

largest Manufacturer of a Complete Line of Lathes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